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To the Readers and the Friends of Isis.

Vol. 1 *and the first part of vol.* 6 *have been out of print for some time, and other volumes are becoming scarcer every day. Every effort is made by the Editor and by the History of Science Society to obtain copies of the volumes out of print. People owning such copies will do us a great favor by giving or selling them to the Society.*

On the other hand every member who wishes to complete his set should communicate as early as possible with the Hon. Secretary Mr. F. E. Brasch, *Library of Congress, Washington, D. C. They are warmly recommended to obtain at once the volumes which are still available, and to enter their order for those which are out of print. Mr.* Brasch *is keeping a list of these desiderata and as soon as they are sufficiently numerous, photographic copies of the missing parts will be made and sold at cost.*

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The Editor.

Studien zu Jābir ibn Ḥayyān

I. Das Wissenschaftsgebäude der Jābirschriften.

Im III. Jahresbericht des Forschungs-Instituts für Geschichte der Naturwissenschaften in Berlin habe ich den vorläufigen Nachweis zu führen versucht, dass die Schriften des JĀBIR IBN ḤAYYĀN, die der Ueberlieferung nach im 8. Jahrhundert unserer Zeitrechnung als die ersten Werke islamischer Naturwissenschaft entstanden sein sollen, in Wirklichkeit dem beginnenden 10. Jahrhundert angehören. Sprachliche Beobachtungen ergaben, dass die wissenschaftliche Terminologie, in der sie abgefasst sind, erst in der Mitte des 9. Jahrhunderts von den grossen Uebersetzern aus dem Griechischen und Syrischen ins Arabische geprägt wurde; das religionsgeschichtliche Resultat lautete dahin, dass sie aus dem Kreise der gnostisch-schi'itischen Sekte der Isma'iliten stammen und eine wichtige Quelle für diese Bewegung darstellen. Mitten in naturwissenschaftlichen Ausführungen geht der Verfasser plötzlich in religiös-politische Agitation über, spricht von dem in der nächsten Zeit erscheinenden Imam, der eine Inkarnation der Gottheit ist, und bei näherer Betrachtung ergibt sich, dass auch seine wissenschaftlichen Lehren von isma'ilitischen Dogmen durchsetzt sind. In dem genannten Aufsatz lag es mir daran, die These von der isma'ilitischen Herkunft der JĀBIRschriften durch Aneinanderreihung und Interpretation von einigen massgebenden Stellen zu begründen. Dort war alles auf den Nachweis selbst zugespitzt und sämtliche anderen Fragen wurden deshalb zurückgestellt. Ich setze hier die dort gegebenen Ausführungen voraus und gehe nun auf synthetischem Wege daran, zu zeigen, was die Jābirschriften eigentlich sind.

Untersuchen wir eine der grossen Schriften JĀBIR's, z.B sein *kitāb al-khawāṣṣ*, das Buch der spezifischen Eigenschaften, so sehen wir, dass neben den Hauptdisziplinen: Alchemie, Talismankunde, Medizin, welche den Grundstock bilden, noch andere stehen,

die offenbar in einem anderen Zusammenhang in den Vordergrund rückten. Wir lesen lange Darlegungen über Mathematik, Musik, Logik, Kosmogonie, Diskussionen über philosophische Fragen, wie Raum und Zeit, Stoff und Form, Kausalität, und in den meisten Fällen werden an solchen Stellen die Titel von Schriften angeführt, in denen diese Themen ausführlicher behandelt waren. Leider ist uns nur ein geringer Teil dieser Schriften erhalten. Für die Folgezeit war JĀBIR in erster Linie Alchemist, er galt als der König der arabischen Alchemie und daher gingen fast sämtliche Schriften verloren, die sich mit anderen Themen befassten, eine Erscheinung, die uns häufig in der islamischen Literatur begegnet. So sind z.B. von den sicher bedeutenden Philosophen AL KINDĪ und AL RĀZĪ die originalen philosophischen Schriften der Vergessenheit anheimgefallen und fast nur die astronomischen Werke des ersteren und die medizinischen des letzteren hat die Ueberlieferung erhalten.

Trotzdem muss die Aufgabe gestellt werden, wenigstens den Rahmen des universalen Wissens JĀBIR's zu rekonstruieren und die Beziehung der oben genannten Hauptdisziplinen zu seinem ganzen Denken zu ermitteln. Erst von hier aus werden die Triebkräfte der Wissenschaft JĀBIR's sichtbar und lässt sich seine Stellung in der islamischen Geistesgeschichte näher umschreiben. Auf Grund dieser Voraussetzung erweist sich der Vergleich seines Systems der Wissenschaften mit anderen Systemen seiner Umgebung als fruchtbar.

Ein glücklicher Zufall hat nun einen kleinen Traktat erhalten, der es ermöglicht, unter Heranziehung der anderen Schriften, wenigstens die Grundzüge der Anlage des Wissenschaftsgebäudes JĀBIR's zu erkennen. Es ist das *kitāb al-ḥudūd*, Buch der Definitionen, das sich in einer einzigen Handschrift in der Bibliothek zu Kairo vorfindet und durch Vermittlung von Dr. M. MEYERHOF dem Forschungs-Institut in einer Photographie zur Verfügung gestellt wurde. S. 1-71 des Kodex enthält eine andere Schrift von JĀBIR, das *kitāb ikhrāj mā fi'l-quwwa ila'l-fi'l*, Buch vom Uebergang aus der Potenz in die Aktion, aus dem im Folgenden auch einige Stellen mitgeteilt werden sollen, und S. 72-86 ist das ' Buch der Definitionen ' angeschlossen. Ueber das Alter der Handschrift lässt sich leider nichts ersehen, sie scheint aber von der gleichen Hand geschrieben zu sein, wie der vorhergehende

Traktat; dieser ist nach der Schlussbemerkung im Jahre 996 H. (1587 n. Chr.) von einer älteren, im Jahre 741 H. (1340 n. Chr.) geschriebenen Handschrift abgeschrieben worden. Der Duktus ist sehr deutlich und die wenigen Fehler lassen sich leicht aus dem Zusammenhang richtig stellen.

Der Titel des 'Buches der Definitionen' wird im *Fihrist* des IBN AN-NADIM (987 n. Chr.), der zwei Schriftverzeichnisse des JĀBIR wiedergibt, nicht erwähnt. Trotzdem gehört es sicher in den Rahmen der Jābirschriften, denn es wird im *kitāb al-khawāṣṣ* (Kap.32) ausdrücklich als ein Traktat der *kutub al-mawāzīn*, Bücher der Massverhältnisse, genannt. Dass es ursprünglich nicht für sich allein stand, geht auch aus seinem ganzen Inhalt hervor. Es will nur eine Ergänzung zu den anderen Schriften einer grossen Sammlung sein und die in ihnen vorkommenden schwierigen Begriffe genauer definieren. Darin besteht aber auch seine besondere Bedeutung: es ist der Schlüssel zum Verständnis der anderen Abhandlungen. Auf S. 76 der Handschrift heisst es:

«Solltest du sagen, dass es unter allen diesen unseren 500 Büchern kein einziges gibt, das nicht diesem Buche an Bedeutung nachsteht, so sagst du die Wahrheit. Da nun aber diese 500 Bücher das Bedeutendste darstellen von allem, was ich verfasst habe, und viel deutlicher, klarer und wertvoller sind als alles, was andere Leute verfasst haben, weil in ihnen die Wissenschaften unserer Meister (1) enthalten sind, so ist dieses Buch wertvoller als alles, was es auf der ganzen Welt an Schriften von uns und von anderen gibt. Denn es umfasst den wesentlichen Inhalt dieser Bücher auf die klarste Weise, mit den richtigsten Definitionen und den deutlichsten Methoden.»

Was sind aber die 'Bücher der Massverhältnisse', deren eines das 'Buch der Definitionen' sein soll? Ihre Zahl wird hier auf 500, im *kitāb al-khawāṣṣ* meist auf 144 angegeben, was auf zwei Rezensionen schliessen lässt. Erhalten ist unter diesem Namen nur eine einzige Schrift von ziemlich unbedeutendem Inhalt, die bei BERTHELOT, *La Chimie au Moyen Age*, Bd. III p. 100 ff.

(1) Die Bezeichnung 'Wissenschaften unserer Meister', *'ulūm sādātinā*, ist ein Hinweis auf die religiösen Grundlagen der gesamten Wissenschaften und ihre Herkunft von den *sādāt* (Meistern), d.h. den 'Aliden, zu denen auch der unmittelbare Meister *(sajjid)* des JĀBIR, der Imam JA'FAR IBN MUḤAMMAD AṢ-ṢĀDIQ gehört. Vgl. *Jahresbericht* S. 27.

von HOUDAS herausgegeben wurde. (2) Es hat aber den Anschein, als wären einmal sämtliche Schriften, die philosophische Fragen behandelten, unter diesem Titel zusammengefasst und veröffentlicht worden. Die philosophischen Kapitel, welche im *kitāb al-khawāṣṣ* enthalten sind, gehörten, wie sich aus ihren eigenen Angaben nachweisen lässt, ursprünglich in den Rahmen der *kutub al-mawāzīn* und wurden erst bei einer Neuausgabe des *kitāb al-khawāṣṣ* diesem angegliedert. *Mīzān* (wovon der Plural *mawāzīn*) ist nach JĀBIR das mathematisch erfassbare Weltgesetz, das aller Wissenschaft zu Grunde liegt. Dieser Begriff, den offenbar JĀBIR selbst erst prägte (2a) und der für ihn den philosophischen Mittelpunkt seines ganzen Systems bildet, wurde von ihm als Ueberschrift der Sammlung seine philosophischen Abhandlungen verwendet. Das ' Buch der Definitionen ' ist also, da es als einer der wichtigsten Traktate dieses Schriftenkreises bezeichnet wird, am besten dazu geeignet, in die philosophischen Lehren des JĀBIR einzuführen.

Dem Titel nach erwarten wir die Aneinanderreihung von Definitionen häufig angewandter Begriffe, in der Art wie sie uns öfter in der islamischen Literatur begegnen und auch den Inhalt einer der Abhandlungen der Lauteren Brüder bilden, die mit dem JĀBIR-Corpus sehr nahe verwandt sind (3). Das ist aber nicht der Fall. In fast allen seinen Traktaten, wo nicht etwa, wie beim Beschreiben von chemischen Verfahren, die Sprödigkeit des Stoffes eine undifferenzierte Aufzählung erfordert, schreitet JĀBIR dazu fort, nach bestimmten Kompositionsgesetzen sein Thema zu gestalten. Die grossen Bücher entbehren oft der umfassenden Einheit, aber die kleinen Traktate, aus denen sie zusammengesetzt sind, sind meist ein Muster von Kompositionsfähigkeit. Trotz des scheinbaren Nebeneinanders ist der Aufbau einer jeden Abhandlung irgendwie organisch aus dem Thema selbst erwachsen und gewährt einen tiefen Einblick in den Formungswillen des Verfassers. Im vorliegenden Buch werden nicht einfach Defini-

(2) Inzwischen sind mir aus der Handschrift der Bibl. Nat. 5099 zahlreiche neue Stücke aus den ' Büchern der Massverhältnisse ' bekannt geworden.

(2a) Über die spezifisch isma'ilitische Bedeutung des Begriffes **mīzān** soll anderswo ausführlich gehandelt werden.

(3) Vgl. *Jahresbericht* S. 46.

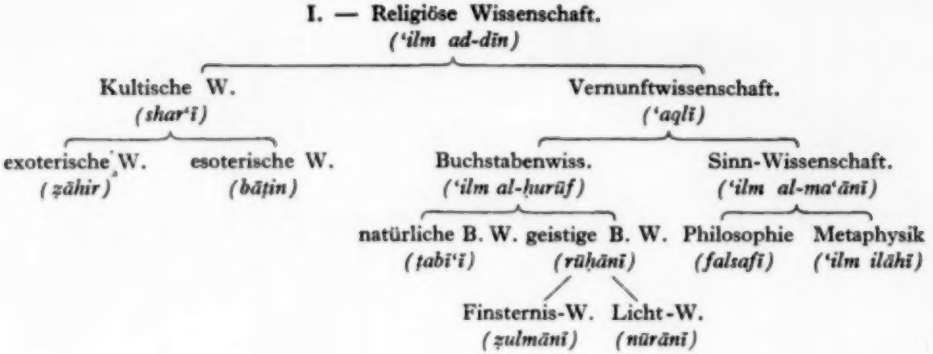
tionen verschiedener philosophischer Begriffe gegeben, sondern, was weit über den Titel der Abhandlung hinausgeht, Definitionen der verschiedenen wissenschaftlichen Disziplinen, wie sie sich in ihrem gegenseitigen Verhältnis dem Verfasser darstellen. So kann uns diese Schrift die oben aufgeworfene Frage nach der Anlage des Wissenschaftsgebäudes JĀBIR's beantworten.

Die Disposition ist kurz folgende: Nach einer längeren Einleitung, die nach Art der Schullogik bestimmt, was als Definition zu gelten hat, folgt eine allgemeine Uebersicht über die verschiedenen wissenschaftlichen Disziplinen. Daran schliesst sich eine ins Einzelne gehende Aufzählung der Definitionen der Wissenschaften. Sie geht von der höchsten Art menschlichen Erkennens herab zu den empirischen Wissenschaften. Darauf folgt unter Beibehaltung der gleichen Reihenfolge ein grosser Abschnitt über die Objekte der einzelnen Disziplinen, die ebenfalls in kurzen Worten definiert werden. Den Abschluss bildet ein Anhang, in dem verschiedene Definitionen, die in dem Rahmen der Aufzählung der Wissenschaften keinen Platz fanden und doch für das Verständniss der *kutub al-mawāzīn* von Bedeutung sind, besprochen werden. So bildet also der Traktat in der Tat das Gerüst für alle anderen Bücher und braucht in seinen Angaben nur stellenweise ergänzt zu werden.

Ich gebe im Folgenden Teile der Schrift in Uebersetzung wieder, weiche dabei aber häufig von ihrer Reihenfolge ab. Es kommt hier nicht so sehr auf das ' Buch der Definitionen ' und seine Eigenart an, sondern auf die Verwertung seiner Angaben für die Wissenschaftslehre des JĀBIR.

Das Grundschema seiner Wissenschaften lässt sich tabellarisch folgendermassen darstellen (vgl. S. 12.)

Schon ein Blick auf diese Uebersicht zeigt deutlich die Tendenz des Verfassers. Die empirischen, ' weltlichen ' Wissenschaften sind dem Rang nach den religiösen untergeordnet und erfahren ihre Begründung erst von ihnen. Die wichtigste weltliche Wissenschaft ist die **Alchemie**, die anderen Disziplinen werden im *kitāb al-ḥudūd* kaum genannt. Sie dienen ihr nur als Hilfswissenschaften oder sind höchstens in ein ' analoges Verhältniss ' zu ihr gestellt. Die Alchemie dagegen ist die einzige weltliche


I. — Religiöse Wissenschaft.
('ilm ad-dīn)
Kultische W.
(shar'ī)
Vernunftwissenschaft.
('aqlī)
exoterische W.
(ẓāhir)
esoterische W.
(bāṭin)
Buchstabenwiss.
('ilm al-ḥurūf)
Sinn-Wissenschaft.
('ilm al-ma'ānī)
natürliche B. W.
(ṭabī'ī)
geistige B. W.
(rūḥānī)
Philosophie
(falsafī)
Metaphysik
('ilm ilāhī)
Finsternis-W.
(ẓulmānī)
Licht-W.
(nūrānī)

II. — Weltliche Wissenschaft.
('ilm ad-dunjā)
Erhabene weltl. W.
(sharīf) = Alchemie (ṣan'a)
Niedere w. W.
(wadī') = die anderen Techniken
um ihrer selbt willen erstrebte W.
(murād li-nafsihi)
= ELIXIR
um einer anderen Sache willen erstrebte W.
(murād li-ghairihi)
Hilfswissenschaften der Alchemie
Selbstgenügende Wissenschaften, die zur Alch. in einem analogen Verhältnis stehen.
rotes E.
weisses E.
Drogenherstellung
(aqāqīr)
Lehre v. den Verfahren.
(tadābīr)
einfache D.
zusammengesetzte D.
äusserliche V.
innerliche
rote V.
weisse V.
rote V.
weisse V.

Wissenschaft, die um ihrer selbst willen erstrebt wird. Sie ist, wie aus anderen Schriften hervorgeht, die Vollendung der empirischen Wissenschaften ; ihre Aufgabe ist die Herstellung des Elixirs, das wegen des harmonischen Verhältnisses seiner Bestandteile als ein neuer, dritter Kosmos, neben Mikrokosmos und Makrokosmos, bezeichnet wird (4). Auf diese Art werden die weltlichen Wissenschaften durch die Alchemie wieder mit den religiösen vereint, von denen sie von Anfang an getrennt waren. Das Elixir kann jetzt den Namen *Imām* führen (5), der in der religiösen Sprache auf die menschliche Erscheinung der Gottheit angewendet wird. Nicht der materielle Vorteil, dass mit Hilfe des Elixirs Gold hergestellt werden kann, ist das Massgebende, denn dann wäre auch die Alchemie eine Wissenschaft, die um einer anderen Sache willen (um des Goldes willen) erstrebt wird. Alle technischen Verfahren sind nutzlos, wenn man nicht im Elixir ein Sinnbild der religiösen Wahrheit sieht.

Wenden wir uns zuerst zu den religiösen Wissenschaften. Die näheren Ausführungen über sie geben die Möglichkeit, die spezifisch isma'ilitischen Grundlagen des Systems (6) in neuer Form zu erkennen. Die Definitionen der einzelnen Disziplinen sind nur aus dem Kreise dieser islamischen Sekte zu verstehen.

Folgendes ist die allgemeine Definition der religiösen Wissenschaften : « Es sind die Formen (εἴδη), mit denen sich die Vernunft schmückt, um sie für das zu verwenden, wovon sie nach dem Tod den grössten Nutzen erhofft. Dieser Definition widerspricht nicht 1) dass sich mit dem religiösen Wissen das Begehren nach Weltherrschaft paart ; 2) die Tatsache, dass die Menschen dem Träger des religiösen Wissens um seinetwillen die grösste Verehrung entgegenbringen ; und 3) dass man, um das religiöse Wissen in Erscheinung treten zu lassen, gegen die Menschen alle Mittel anwenden darf. »

Das religiös-politische Programm der frühen Ismā'īlijja kann gar nicht besser ausgedrückt werden. Nach der Auffassung vieler, besonders mystischer Strömungen im Islam war Religion völlige

(4) S. *Jahresbericht* S. 35.

(5) a. a. O. S. 36.

(6) Ich verweise auf die kurze Darstellung der Ismā'īlijja in der genannten Abhandlung.

Abkehr von irdischem Besitz und politischer Macht, ein reines Hinwenden auf das Jenseits. Der isma'ilitischen Lehre zufolge begründet der erscheinende Imam das Reich Gottes auf Erden. Er ist der wahre Träger göttlichen Wissens und daher der wirkliche Repräsentant der Vernunft (*νοῦς*). Ihm allein gebührt die Verehrung aller Menschen. Diese These gilt nicht nur in der Theorie. Gerade in der Zeit, da, wie ich glaube nachgewiesen zu haben, JĀBIR seine Werke verfasste, begründeten die Fatimiden, begünstigt von isma'ilitischer Propaganda, in Nordafrika ihren Staat und waren ihren Anhängern nicht nur religiöses Oberhaupt, sondern die Gottheit selbst. — Und jene macchiavellistische Lehre, dass alle Mittel gut sind, die dazu führen, ' die göttliche Wahrheit in Erscheinung treten zu lassen ', ist innerhalb des Islam nur von der Ismā'īlijja formuliert worden. Ein Gegenstück zur obigen Stelle ist eine Erzählung in den Abhandlungen der Lauteren Brüder, die, wie längst erkannt, ein isma'ilitisches Werk darstellen. Ein Arzt kommt in eine Stadt und sieht die ganze Bevölkerung an einer schweren Krankheit leiden. Oeffentlich kann er nicht daran gehen, die Menschen zu heilen, weil sie in ihrem Hochmut unzugänglich sind und ihn steinigen würden. Er gewinnt sich einen Freund aus ihrer Mitte, bringt ihm das Heilmittel bei und verlangt als Dank nur, dass er ihm weitere Menschen zuführe. So wird nach und nach ein grosser Teil der Bevölkerung von dem Leiden befreit, d.h. für die neue Lehre gewonnen. « Dann traten sie offen auf und zwangen den übrigen die Heilung auf. Jeden, den sie trafen, fassten sie bei Händen und Füssen und verabreichten ihm mit Gewalt das Heilmittel, bis sie alle Leute der Stadt geheilt hatten ».

Im Mittelpunkt der isma'ilitischen Dogmatik stehen gnostisch-neuplatonische Spekulationen, die nur ganz äusserlich mit einem islamischen Firniss überzogen sind. Die eigentliche islamische ' religiöse Wissenschaft ', d.h. die Kenntniss der Vorschriften und Dogmen, die für jeden Muslim gelten, wird durch eine allegorische Methode *(ta'wīl)* ihres urspünglichen Inhalts beraubt. Die Unterscheidung von äusserer, exoterischer Religion *(ẓāhir)* und ihrem inneren, esoterischen Wesensgehalt *(bāṭin)*, in dem die kultischen Handlungen zu philosophischen Schemen verflüchtigt sind, ist ein spezifisches Merkmal der Ismā'īlijja. Ebenso wird

auch im *kitāb al-ḥudūd* die kultische Wissenschaft in einen äusseren und einen inneren Teil eingeteilt. Die zugehörigen Definitionen lauten :

« Die Definition der **kultischen Wissenschaft** (7) : das Wissen von den religiösen Uebungen *(sunan)*, die, wenn sie ihrem wahren Wesensgehalt entsprechend vor dem Tode ausgeführt werden, **nach dem Tode** Nutzen bringen ».

« Die Definition der **äusseren** (exoterischen) Wissenschaft : Das Wissen von der allgemeinen Bedeutung der religiösen Uebungen ».

« Die Definition der **inneren** (esoterischen) Wissenschaft : das Wissen von den **Gründen** der religiösen Uebungen, und von dem verborgenen speziellen Zweck, der mit dem exoterischen erstrebt wird. »

Neben dem Kultus *(shar')* steht eine viel höhere Form von ' Religion ', der *'ilm al-'aql*, die Vernunftswissenschaft, die die ganze eigenartige isma'ilitische Metaphysik, aber auch alle anderen philosophischen Disziplinen und besonders die Naturphilosophie in sich schliesst. Ich gebe die diese Wissenschaften betreffenden Definitionen in Uebersetzung wieder und schliesse im Folgenden einige Bemerkungen an.

« Die Definition der **Vernuftwissenschaft :** Es ist das Wissen von dem, was den Sinnen verborgen bleibt, und womit sich die partielle (d.h. menschliche) Vernunft schmückt. Es betrifft die erste Ursache, die Allvernunft, die Allseele, die partielle Vernunft und die partielle Seele und zwar in dem Sinn, dass dadurch in der Welt des Entstehens (im Diesseits) der Vorzug zeitweilig erworben wird und man dadurch in die Welt der Ewigkeit gelangt. — Die Vernunft selbst ist die einfache Substanz, die die Formen (Ideen) der Dinge in ihrem wahren Wesensgehalt aufnimmt, so wie ein Spiegel die ihm gegenüberstehenden Formen und Gestalten aufnimmt ».

« Die Definition der Wissenschaft von den **Buchstaben :** Es ist ein Wissen, das die vier Forschungsarten der Buchstaben umfasst, nämlich die Fragen nach Ob und Was und Wie und Wozu. Die Buchstaben selbst sind : die Figuren, die auf Grund

(7) Genauer : ' kultischen Gesetzgebung '.

der Konvention auf die Laute (Worte) hinweisen, welche derart abgegrenzt sind, dass sie durch ihre Anordnung auf die Bedeutung (jener Worte) hinweisen. »

« Die Definition der Wissenschaft von den **Bedeutungen :** Es ist das Wissen, welches das, was die Buchstaben in natürlicher Weise erfordern, als durch Beweis erkannt umfasst. Die Bedeutungen selbst sind : Die Formen (Ideen), auf die die Buchstaben hinweisen sollen. »

« Die Definition der **natürlichen** Seite der Buchstaben-Wissenschaft : Das Wissen von den Qualitäten (d.h. Wärme, Kälte, Trockenheit und Feuchtigkeit), die je sieben von den Buchstaben zukommen. Die Natur selbst ist die Ursache für die aus ihr stammenden Dinge des Entstehens und Vergehens. »

« Die Definition der **geistigen** Seite der Buchstabenwissenschaft : Das Wissen von dem, wovon die Buchstaben nur die Auswirkungen darstellen, nämlich von Licht und Finsternis. Der Geist selbst ist ein subtiles Wesen, das die aktive Idee darstellt. »

« Die Definition der **Lichtwissenschaft :** Sie ist das Wissen von dem Wesensgehalt des Lichtes, welches auf Alles emaniert und allen Dingen strahlende Helle schenkt, in dem es sich mit ihnen, entsprechend ihrer Aufnahmefähigkeit, vermischt. »

« Die Definition der **Finsterniswissenschaft :** Sie ist das Wissen von dem Gegensatz des Lichtes, d.h. von der Tatsache, dass den Dingen das Licht oder seine Einwirkung abgeht. »

« Die Definition der **philosophischen** Wissenschaft : Sie ist das Wissen vom dem Wesensgehalt der existierenden, im Kausalitätszusammenhang stehenden Dinge. »

« Die Definition der **göttlichen** Wissenschaft (Metaphysik) : Sie ist das Wissen von der ersten Ursache und was aus ihr ohne Vermittlung oder höchstens durch ein einziges Mittelglied hervorgegangen ist, oder : Die Metaphysik ist das Wissen von dem, was jenseits der Natur ist (*μετὰ τὴν φύσιν*), nämlich von der Vernünftigen Seele *(nafs nāṭiqa)*, der (All-)Vernunft *('aql)* und der Ersten Ursache *('illa 'ūlā)* ».

Aus der Ausführlichkeit, mit der JĀBIR über die Vernunftwissenschaften handelt, können wir mit Sicherheit schliessen, dass sie einmal den eigentlichen Mittelpunkt seines Systems bildeten. Sie umfassen alles spekulative Denken und haben als Ziel die

Erlösung der Seele. Ich behalte es mir vor, an anderer Stelle näher auf die Einzelheiten einzugehen und erörtere hier nur jene Punkte, die für das Verständnis der obigen Definitionen unbedingt notwendig sind. Die grösste Schwierigkeit bereitet die Disziplin: ‘Buchstabenwissenschaft’. Die Lehre von den Buchstaben geht von der Voraussetzung aus, dass die Namen der Dinge etwas Göttliches sind, ihnen nicht durch menschliche Uebereinkunft (*θέσει*), sondern von Natur aus (*φύσει*) anhaften und man daher von den Bestandteilen der Namen, den Buchstaben, auf das Wesen der Dinge, ihre Zusammensetzung und ihren Zweck (Ob, Was, Wie, Wozu!) schliessen kann. Diese Anschauung bildet den Grundpfeiler der alchemistischen Theorie JĀBIR's. Die 28 Buchstaben des arabischen Alphabets werden in vier Gruppen geteilt, und je sieben von ihnen entsprechen in einer Tabelle immer einer der vier Qualitäten. (8) Durch die Analyse der Buchstaben eines Stoffnamens wird der quantitative Gehalt des Stoffes zahlenmässig bestimmt und die Voraussetzung für die Verwandlung des Stoffes d.h. der Beziehung seiner Qualitäten unter einander gegeben. Alle Stoffe unserer Welt sind aus den vier Qualitäten zusammengesetzt, daher unterliegen alle diesem Gesetz, das in seiner philosophischen Ausprägung den Namen *‘ilm al-mīzān* (Wissenschaft vom Massverhältnis) trägt.

Undeutlich ist in diesem Zusammenhang die andere Seite der Buchstabenwissenschaft, bei der von den Qualitäten der Dinge zu einer dualistischen Einteilung sämtlicher Erscheinungen in solche, die dem Lichtreiche, und solche, die der Finsternis angehören, fortgeschritten wird. Die bisher bekannten JĀBIRtexte geben für diese Lehre noch wenig Anhaltspunkte. Die Terminologie (Licht und Finsternis) erweist aber auch diese Lehre als gnostisch.

Die eigentliche spekulative Wissenschaft ist die Lehre von den **‘Bedeutungen’**, dem inneren Wesensgehalt der Dinge. In den Rahmen der als philosophisch bezeichneten Disziplinen fallen neben Fragen der Kausalität, Logik, Erkenntnislehre usw. auch die Musik, Mathematik, Physik und Astronomie. Dagegen befasst sich die Metaphysik nur mit den ersten Prinzipien, die jenseits menschlicher Erfahrung liegen und eine Emanationsreihe:

(8) Vgl. bei BERTHELOT-HOUDAS, a. a. O. Texte p. 126, Trad. p. 158.

Erste Ursache, Weltvernunft, Weltseele darstellen. Hierher gehört offenbar auch die Kosmogonie, d. h. die Frage nach der Herkunft dieser Emanationen und die Lehre von dem Niederstieg der Seele in die Welt.

Erst an dieser Stelle werden die weltlichen, empirischen Wissenschaften eingeordnet. Ihre Definition lautet : « Sie sind die Ideen, welche die Vernunft **und** die Seele erwerben, um noch **vor dem Tode** sich Vorteile anzueignen und Schädigungen abzuwehren. Wir haben aber in dieser Definition gesagt, dass sowohl die Vernunft als auch die Seele diese Ideen erwirbt, weil die Vorteile und Schädigungen mit den menschlichen Begierden zusammenhängen, und diese sind eine Eigenschaft der Seele. Das Wissen, welches sie betrifft, ist daher auf die Seele beschränkt. Denn die Vernunft ist ein Feind der Begierde. Ferner gibt es aber auch Dinge, die mit dem Urteil zusammenhängen, und deren Wissen ist auf die Vernunft beschränkt. Aus diesem Grunde haben wir die Seele mit in die Definition aufnehmen müssen ».

Leider geht nun JĀBIR im Folgenden nur auf die Alchemie näher ein. In dem Rahmen der *kutub al-mawāzīn*, denen das ' Buch der Definitionen ' angehört, kam es dem Verfasser in erster Linie auf eine theoretische Begründung dieser Disziplin an ; die anderen empirischen Wissenschaften werden mit der kurzen Bemerkung abgetan, dass sie nicht um ihrer selbst willen, beziehungsweise nur als Analoga zur Alchemie existieren.

Hier hilft nun eine andere Aufzählung und Behandlung von Wissenschaften weiter, die im ' Buch vom Uebergang aus der Potenz in die Aktion ' enthalten ist. Sie ordnet sich nicht glatt in das im ' Buch der Definitionen ' gegebene System ein, aber an solchen kleinen formalen Widersprüchen sind die Jābirschriften reich, und sie erlauben vielleicht Schlüsse auf den Autor oder seine Schule zu ziehen. (9)

Der Hauptteil dieses Traktates ist **astrologischen** Fragen und besonders der Abhängigkeit der irdischen Erscheinungen von der Welt der Sterne gewidmet. Danach werden die Wissenschaften in einem Siebenersystem gruppiert und jede einzelne genau beschrieben :

(9) Zur Schule JĀBIR's siehe demnächst meinen Aufsatz in der Zeitschrift : *Der Islam*.

1. **Medizin,** *'ilm aṭ-ṭibb :* Die Tatsache, dass diese Disziplin an der Spitze der Aufzählung gestellt wird und sogar der Alchemie vorangeht, steht in offenbarem Widerspruch zu der einzigartigen Hochschätzung der Alchemie im *kitāb al-ḥudūd.* Sie ist aber auch sonst zu belegen. An mehreren Stellen der Jābirschriften wird die Medizin als die wichtigste Wissenschaft und als das wertvollste Erbe der Alten bezeichnet. Es scheint, dass JĀBIR, bevor er sich ausschliesslich der Alchemie widmete, in erster Linie Mediziner war. Sein ' Buch der Gifte ' ist jedenfalls ein Zeugnis seiner tiefdringenden medizinischen Bildung.

2. **Alchemie,** *'ilm aṣ-ṣan'a :* Von ihr handeln die meisten Werke, die von JĀBIR erhalten sind.

3. **Die Wissenschaft der spezifischen Eigenschaften,** *'ilm al-khawāṣṣ :* Ihr ist besonders das ' Buch der spezifischen Eigenschaften ' gewidmet. Es enthält die Beschreibung von auffälligen Reaktionen verschiedener Stoffe, die einer bestimmten Behandlung ausgesetzt werden.

4. **Talismankunde,** *'ilm al-ṭilasmāt :* Dies ist « die grosse gewaltige Wissenschaft, die leider in unserer Zeit, der Zeit der dialektischen Philosophen *(mutakallimūn)*, sehr brach liegt ». Sie versucht Einwirkungen irdischer und himmlischer Erscheinungen auf den Menschen durch Analogiezauber und Gegenwirkung *(mumāthala* und *muqābala)* zu bannen.

5. **Die Wissenschaft von der Dienstbarmachung der oberen Welt, d.h. der Sterne,** *'ilm istikhdām al-'ulwijjāt :* Sie lehrt, welche Opfer und Gebete den einzelnen Planeten darzubringen sind, um sie zu beeinflussen. Einige Abhandlungen, die über diese Disziplin handeln, sind erhalten, z.B. das *kitāb al-malik*, Königsbuch, (10) und das *kitāb al-baḥth* (11), Buch der Forschung. Besonders diese Wissenschaft zeigt die enge Verwandtschaft der Lehren JĀBIR's mit denen der ḥarrānischen Ṣābier.

6. **Die Wissenschaft von den Zahlenverhältnissen,** *'ilm al-mīzān :* Als die Grundlehre JĀBIR's ist sie hier ans Ende gestellt. Im Buch der Definitionen war sie unter die Vernunftwissenschaften eingereiht.

7. Als Hilfswissenschaft wird noch, um die Zahl Sieben voll zu

(10) E. J. HOLMYARD, *The Arabic Works of Jābir ibn Hajjān*, p. 161f.
(11) Handschrift in Konstantinopel.

machen, hinzugezählt: **Die Wissenschaft von der Herstellung,** ***'ilm at-takwīn***, deren Inhalt die Lehre von den Apparaten und Methoden zur richtigen Handhabung der anderen Disziplinen bildet.

Ich habe hier an der Hand des 'Buchs der Definitionen' und des 'Buchs vom Uebergang aus der Potenz in die Aktion' die Konturen des Wissenschaftsgebäudes JĀBIR's zu zeichnen versucht. Es wird die Aufgabe der Zukunft sein, den Inhalt der einzelnen Disziplinen in aller Klarheit herauszuarbeiten. Leider ist ein grosser Teil der JĀBIRschriften wahrscheinlich für immer verloren gegangen. Aber man wird aus den häufigen Zitaten und Exkursen in den uns erhaltenen Schriften die Hauptzüge seiner Lehren rekonstruieren können. Ausser von der Alchemie, Talismankunde und Medizin, von denen fast alle Bücher handeln, erhalten wir auch ein deutliches Bild von den religiösen und philosophischen Anschauungen des Verfassers. Ein Versuch, besonders die ersteren zu begreifen, ist in dem oben zitierten Aufsatz gemacht worden. Weitere Beiträge in dieser Richtung werden in absehbarer Zeit folgen.

Die Frage nach dem Wissenschaftsgebäude des JĀBIR ist von der grössten Bedeutung. Von hier aus kann der Vergleich mit ähnlichen Erscheinungen seiner Zeit und besonders solchen innerhalb der isma'ilitischen Literatur unternommen werden. Es sei vorläufig hervorgehoben, dass in der Enzyklopädie der Lauteren Brüder keine einzige Wissenschaft genannt ist, die nicht auch bei JĀBIR in Betracht gezogen wird. Dies bestätigt die von mir festgestellte Verwandtschaft der beiden isma'ilitischen Werke.

II. Die Jābir-Legende

Wenn die These zu Recht besteht, dass die angeblichen Schriften JĀBIR's erst um die Wende des 9. Jahrhunderts entstanden sind, so haben die Angaben, die in ihnen über das Leben ihres Verfassers enthalten sind, keinen geschichtlichen Wert. Es ist möglich, dass im 8. Jahrhundert ein Mann namens JĀBIR IBN ḤAYYĀN gelebt hat, der zum Träger eines ganzen Schrifttums gemacht wurde; was wir aber von ihm wissen, ist Legende und seine späteren

Biographen (IBN AN-NADĪM, JILDAKI u.a.) haben nur unsere Jābirschriften als Quelle. Ich übersetze im Folgenden einige angeblich autobiographische Erzählungen, die in einzelnen Büchern JĀBIR's enthalten sind. Wenn ihnen auch nichts über den alten JĀBIR entnommen werden kann, so erlauben sie doch, einige Schlüsse auf den Verfasser der Schriften und seine Tendenzen zu ziehen.

Die Erzählungen zerfallen in drei Gruppen : Berichte 1) über die medizinische Praxis JĀBIR's ; 2) über seine alchemistische Tätigkeit ; 3) über sein Verhältnis zu seinem Meister JA'FAR IBN MUḤAMMAD AṢ-ṢĀDIQ.

I

« Eine mir bekannte Frau klagte mir einmal, dass sie wenig Haare habe, dass sie ihr ausfielen, anstatt in krausen Locken herabzuhängen. Da gab ich ihr zwei Drachmen (von dem Elixir) und befahl ihr, es in ein halbes Ratl Schweinefett hineinzutun — sie hatte nämlich ein kaltes Temperament — und damit ihren Kopf einzufetten. Kaum waren fünf Monate verstrichen, als ich erfuhr, dass ihr das Haar in krausen Locken bis zu den Fersen reichte. » (*kitāb al-khawāṣṣ*, Kap. 8.)

« Ja, bei meinem Meister, ich habe damit (mit dem Elixir) mehr als tausend Personen an einem einzigen Tag gerettet und das ist allgemein unter den Leuten bekannt geworden.

Eines Tages, nachdem mein Ruf in diesen Wissenschaften schon begründet war, befand ich mich bei YAḤYĀ IBN KHĀLID. Der hatte eine edle Sklavin, begabt mit Schönheit, Vollkommenheit, Wohlerzogenheit, Verstand und Fertigkeiten. Niemand (sonst) besass eine solche Sklavin. Sie hatte wegen eines Unwohlseins, das sie in sich verspürte, ein abführendes Mittel getrunken. Das nahm sie aber heftig mit und sie erbrach so viel, dass man für einen Menschen ihrer Konstitution keine Rettung oder Heilung erwarten durfte. Das Erbrechen übermannte sie, so dass sie überhaupt nicht mehr atmen oder sprechen konnte. Der Bote ging, es YAḤYĀ zu melden. Der sagte zu mir : « Mein Meister, was glaubst du, hilft dagegen ? » Da riet ich ihm zu kaltem Wasser, das man über sie giessen sollte. Denn ich hatte sie nicht

gesehen, und ausserdem wusste ich für einen solchen Fall keine Heilung.

Er vollführte das, aber weder etwas Kaltes noch Warmes wollte Hilfe bringen. Ich hatte nämlich auch veranlasst, ihren Magen mit warmem Salz zu erwärmen und ihre Füsse damit zuzudecken. Als aber die Sache immer nur ärger wurde, forderte er mich auf, sie zu sehen. Ich sah sie fast tot und ihre Kräfte waren sehr geschwächt. Nun hatte ich aber ein wenig Elixir bei mir, und davon gab ich ihr zwei Gran zusammen mit drei Unzen reinem Sauerhonig. Bei Gott und bei meinem Meister, ich musste mein Antlitz vor dem Mädchen verhüllen, denn in weniger als einer halben Stunde war ihre Vollkommenheit in noch weit höherem Masse, als sie sie früher besessen hatte, wiederhergestellt.

Da warf sich YAḤYĀ vor mir nieder und küsste meine Füsse. Ich sagte ihm: « Mein Bruder, tue das nicht! » Er aber fragte mich nach dem Nutzen des Mittels. Ich antwortete: « Nimm, was ich davon bei mir habe. Es wird sicher in deiner Hand nicht wirken. » — Danach aber begann er sich der Uebung und dem Studium der Wissenschaften zu widmen, bis er viele Dinge wusste. Sein Sohn JA'FAR war aber klüger und intelligenter als er ».

« Ich besass eine Sklavin, die hatte, ohne es zu wissen, eine ganze Unze gelbes Arsenik aufgegessen — so erzählte sie wenigstens. Ich fand für sie kein Heilmittel, obzwar ich nicht ein einziges Mittel unversucht liess, das gegen Gifte hilft. An alle dachte ich und behandelte sie mit ihnen. Danach gab ich ihr davon (von dem Elixir) ein Gran zusammen mit Honig und Wasser. Kaum war es in ihren Leib gelangt, da warf sie das ganze Arsenik aus und gewann wieder ihr ursprüngliches Aussehen. » (*kitāb al-khawāṣṣ*, Kap. 6.)

« Eines Tages ging ich aus meiner Wohnung in der Richtung zum Hause meines Meisters JA'FAR (Gott habe ihn selig). Da traf ich einen Menschen, dessen ganze rechte Seite angeschwollen war und, ohne Uebertreibung, grün wurde wie Küchenkräuter. Während nun schon die Blauschwärze an manchen Stellen hervorkam, fragte ich, was mit ihm los sei. Man sagte mir, eine Viper habe ihn eben gebissen und da habe ihn dies betroffen.

Ich gab ihm nur zwei Gran (vom Elixir) mit kaltem Wasser zu trinken, denn ich fürchtete, er würde schnell umkommen. Aber bei Gott, ich sah, wie seine grüne und schwarzblaue Farbe sich verwandelte und wieder in seine ursprüngliche Körperfarbe überging. Danach wurde jene Anschwellung ganz klein, bis man überhaupt nichts mehr von ihr erkannte. Er begann zu reden, stand auf und ging gesund fort, ohne jedwede Krankheit. Es wäre nötig gewesen, ihm Honig oder ähnliches zu trinken, sowie Rosinen und Haselnüsse zu essen zu geben. Aber so ging die Sache schneller vor sich und Gott schenkte ihm das Leben wieder... Ich kenne noch zahlreiche Geschichten darüber, aber ich kann sie in dieser Abhandlung nicht wiedergeben, da der Raum zu klein dafür ist. Wir müssen vielmehr in aller Eile zum Wesentlichen fortschreiten, so Gott will ». (*kitāb al-khawāṣṣ*, Kap. 6.)

II

« Eines Tages — es war am siebenten Tage des Monats Ramaḍān — lud mich JA'FAR IBN YAḤYĀ zu sich ein. Mit uns war noch YAḤYĀ und KHĀLID, der Bruder des JA'FAR. Wir verblieben bei ihm in Angelegenheit eines Kaufes von Sklavinnen. Dann, als dies fertig war, begannen wir über die spezifischen Eigenschaften, besonders im Bereich jener Grundelemente (Feuer, Wasser, Erde, Oel) zu sprechen. Dabei gelangten wir zu den spezifischen Eigenschaften des Oeles (d.h. des Elixirs in Gestalt des Oeles).

Da sagte JA'FAR : Ich habe davon Wunderbares beim Eisen zu sehen bekommen. Ich nahm nämlich einen Stab aus nicht härtbarem Eisen, glühte ihn und tauchte ihn in das Oel siebenzig Mal ein. Da kam er als Silber hervor.

KHĀLID sagte : Ich erlebte dabei ein ähnliches Wunder : Ich löste in dem Oel ein wenig Molken und Alaun auf, erhitzte dann Kupfer und tauchte es hundert und zwanzig Mal hinein. Dann schmolz ich es zuletzt und goss es in das Oel. Es kam als weisses Silber hervor, schöner als jedes Silber.

YAḤYĀ sagte : Ich sah seine wunderbare Wirkung am Silber. Ich glühte nämlich das Silber und tauchte es ins Oel. Immer, wenn zehn Glühungen vorüber waren, mischte ich je zehn Teile

Silber mit drei Teilen Kupfer. Am Ende wurde alles ganz reines unzweifelhaftes Silber.

Nun wandten sie sich zu mir — ich hatte nämlich noch nichts gesagt — und sprachen : « All dies ist dir ja geläufig, ABŪ MŪSĀ, und du weisst darüber Bescheid. Was ist denn deine Meinung hierüber ? Erzähle es uns ! »

Da sagte ich zu YAḤYĀ : Wie ging denn deine Sache zu Ende, nachdem du es geglüht und eingetaucht hattest ? Er antwortete : Richtig ! Als ich bis zu siebzig Malen gelangte, da mischte ich alles, was ich von da an zehnmal glühte, mit der gleichen Menge von Kupfer, und das Ganze wurde Silber in der gleichen Art, wie es zuvor gemischt worden war. So gewann also das Kupfer die Fähigkeit, zugleich mit dem Silber zu färben, und gab seine Kupferart auf. Das ist es, was ich beobachtet habe.

Ich fragte ihn : Was war aber nachher ? Da antwortete er : Als es über hundert (Glühungen) hinausging, da geschah es, dass es von da an nach je zehn weiteren Glühungen die doppelte Menge (seiner selbst) von Kupfer färbte und auch dies in reines Silber umsetzte. So ging es bis zu hundert und fünfzig. So weit habe ich es gebracht und bin bis hierher damit gekommen. Gib es her, Bursche ! — Er rief ihn und siehe, es war ein Silber, das nicht das Aussehen von (gewöhnlichem) Silber hatte, vielmehr war es fein, lieblich, glänzend und schön und übertraf jedes andere Silber.

Da sagte ich zu ihm : Je zehn Glühungen von diesem Zeitpunkt an färben die dreifache Menge bis zu dreihundert. Gelangt man bis zu dreihundert, so färbt bei jeder folgenden Glühung ein Teil Silber die dreifache Menge von Kupfer. Geht es über dreihundert hinaus, so wird es jedes Mal, wenn du es glühst und in das Oel untertauchst, die gleiche Menge färben. So geht es bis zu vierhundert. Da aber gelangt es zu seinem Ziel und wird (selbst) ein edles Elixir.

Da sagte er : Ich will es bis fünfhundert bringen. Ich antwortete : Tue es.

Danach wandten sie sich zu mir und sprachen : Sage uns noch mehr darüber ! Ich antwortete : Gern ! Es macht mir alle Ehre ! Nur wenn du diese (Operation) in Oel vornimmst, erreicht es diese Stufe. Das ist doch sonderbar !

Sie fragten mich nach der Ursache und fanden es wirklich sehr sonderbar. Dann sagten sie: Wären wir nur über das Oel allein unterrichtet, nicht über das Feuer und die Farbe, könnte man es dann nicht auch so einrichten, dass das Oel auch zu Gold färbt?

Ich antwortete: Gott bewahre! Sie fragten mich nach dem Grund dafür und begannen mir Komplimente zu machen: Es sei ja wirklich wunderbar! Ich sagte: Die Ursache, die im Eisen, Kupfer und Silber diese Wirkung schafft, ist, dass das Oel diesen Körpern (Metallen) Weichheit verleiht. Die Farben (Färbefähigkeiten) sind in ihnen verborgen und versteckt enthalten. Wenn sie nun durch das Oel weich werden, können sie ihre Farben verbreiten und sie werden zu anderen Körpern (Metallen) gefärbt. Merke dir dies und verstehe es.» (*kitāb al-khawāṣṣ*, Kap. 10.)

«Eines Tages war ich bei ISḤĀQ IBN MŪSĀ IBN YAQṬIN und traf bei ihm einen tüchtigen Mann von den Alchemisten, wie ich seinesgleichen noch nicht unter den um diese Kunst Beflissenen gesehen hatte. Wir kamen in der Unterhaltung bis zu dieser Stelle, und als wir uns dann darüber aussprachen, dass ein Ding diese Wirkung mit einem Male ausüben kann, sagte er: Mein Herr, Du weisst doch, dass es nach den Philosophen (oder wenigstens) nach der äusseren Form ihrer theoretischen Darlegungen ausgeschlossen ist, dass ein Ding von Kupferhaltigkeit oder anderem in Goldhaltigkeit umgesetzt werden kann, ohne die Vermittlung des Silbers. Erst dann (über dieses Mittelglied hinweg) wird es zu seinem Goldgehalt kommen!

Ich sagte: Weisst du, wieso das ist, mein Bruder?

Er sprach: Nein, bei Gott!

Ich: Es ist für jeden Verstand von vorneherein ausgeschlossen, dass ein Erstes in ein Drittes übergeht, ohne im Zweiten haltzumachen. Nun sind aber doch alle Körper in ihren Massverhältnissen dem Gold untergeordnet?

Er: Ja!

Ich: Ferner ist aber auch das Silber dem Golde näher als alle Körper, nicht?

Er: Ja!

Da sagte ich ihm: Man hat also notwendig als absurd erklärt,

dass einer von diesen Körpern in den Körper des Goldes übergehe, ohne vorher Silber geworden zu sein ! Denn angenommen, Gold entspricht der Zahl Zehn, Silber entspricht Neun und die übrigen Körper den Zahlen Acht bis Eins. Dann ist es ja absurd, dass diese Zehn erreichen, ohne vorher Neun zu erreichen. Merke dir dies !

Als ich ihm das mitgeteilt hatte, sagte er : Ja, es ist ein ganz wunderbarer Ausspruch. Wie aber wird das, worüber wir, mein Herr, gesprochen haben, wahr ? Die Wahrheit kann doch nicht in zwei sich widersprechenden Richtungen liegen !

Ich : Du hast mir vom ersten Augenblick an bis jetzt sehr wohlgefallen, als wärest du in das Tor der Weisheit eingetreten!

Er : O ja, mein Herr. Ich bitte dich, dass du mich belehrst, wie es damit steht.

Ich : Gut ! Hättest du das verwendet, wovon wir zu seiner Stunde hier redeten, so hättest du den richtigen Weg gefunden. Vorher gab es nämlich zwischen uns eine Unterhaltung über die Ceration und dabei wurde viel Gutes gesagt.

Er : Was ist das, mein Herr ?

Ich : Treten doch einige Dinge in die Ceration ein und du weisst es nicht und hast die Ceration noch nicht vorgenommen ?

Er : Ich bitte dich, wiederhole das Thema !

Ich : Es gelangt in dem Verfahren bis zum neunten (Grad), ohne das wir es bemerken. Wir müssen darauf achten, damit, wenn das herzustellende Gold bis an die Grenze der Silberhaltigkeit in der Ceration gelangt ist, das Kupfer zu Silber gefärbt wird.

Er sagte : Du hast recht. » (*kitāb al-khawāṣṣ*, Kap. 10.)

« Das Rezept zur Herstellung des Firnisses, mit dem man Seide imprägniert, habe ich von AL-FAḌL IBN YAḤYA IBN BARMAK erhalten und selbst angewandt. Als ich ihn fragte, ob es seine eigene Erfindung sei, sagte er : Nein, ich fand es in alten zerrissenen Büchern, dies und eine Anzahl von anderen Rezepten ; ich erprobte sie alle, sie waren alle richtig. Es war aber weder am Anfang noch am Ende der Name des Buches genannt, so dass man nicht wissen kann, was es war. » (folgt das Rezept ; *kitāb al-khawāṣṣ*, Kap. 30.)

III

« Mein Meister pflegte oft zu mir zu sagen : Mache deine Versuche, womit du willst, o JĀBIR, und offenbare das Geheimnis deiner Verfahrungsweisen, wie du willst, doch soll es nur der Würdige empfangen, der es in Wahrheit begreift ». (*kitāb al-khawāṣṣ*, Kap. 19.)

« Wie könntest du in den vollkommenen Besitz des Wissens gelangen, ohne das Buch *al-ḥāṣil* gelesen zu haben ! Es gibt auf der ganzen Welt nichts, was nicht in ihm enthalten wäre. Bei Gott, mein Meister schalt mich heftig, dass ich es verfasst hatte (12). Er sagte : ' Bei Gott, o JĀBIR, wüsste ich nicht, dass dieses Wissen nur der Würdige erhalten wird, und wüsste ich nicht mit aller Bestimmtheit, dass er gleich dir sein wird, so würde ich dir befehlen, dieses Buch von der Welt verschwinden zu lassen. ' Weisst du denn, was ich den Menschen darin offenbart habe ? Kannst du also nicht zu (dem Elixir) gelangen, so bemühe dich, dieses Buch zu finden. Es wird dir die tiefsten Geheimnisse meiner Bücher offenbaren, die Wissenschaft von den gewichtigsten Inhalten und alle Vorteile der Weisheit. Durch es wirst du, bei meinem Meister, ein richtiger Alchemist und lernst Schlechtes von Gutem scheiden ». (*ibid.*, Kap. 16.)

« Es sagte mir mein Meister : O JĀBIR, du hast von Allah das vollkommenste Erbarmen und die vollkommenste Gnade erlangt, dafür dass du die Menschen von diesen Nöten und Leiden befreitest, ihnen ihren Verstand wiedergabst und ihr Hab und Gut erhieltst ». Ich antwortete : « Ruhm und Preis und Dank meinem Meister, durch ihn weiss ich, was ich weiss und erreichte ich, was ich erreichte ». (*kitāb al-khawāṣṣ*, Kap. 20.)

« Wir wollen dir nun an dieser Stelle erklären, warum der Talisman *ṭilasm* heisst. Wir haben zu niemandem ausser zu dir darüber gesprochen. Uns aber ist es überliefert worden von der Mine der Weisheit und ihrem Schöpfer (d.h. JA'FAR).

Er sagte : O JĀBIR !

(12) Aehnlich *Kitāb ar-raḥma aṣ-ṣaġīr*. BERTHELOT, a. a. O. S.

Ich darauf: Zu Diensten, mein Herr!

Er: Weisst du, warum der Talisman *(ṭilasm) ṭilasm* heisst?

Ich: Nein, bei Gott, mein Herr, ich weiss es nicht.

Er: Denke darüber nach; es gehört in den Bereich deines Wissens!

Da dachte ich ein ganzes Jahr darüber nach und wusste nicht, was es ist. Ich sagte: Nein, bei Gott, mein Herr, ich weiss nicht, was es ist!

Er sagte: **Hätte ich dich nicht mit eigener Hand gepflanzt und dich von Anfang bis zuletzt hochgezogen** bis zum heutigen Tag, so würde ich sagen, dass du verdunkelt bist! Wehe dir! Dreh es doch um! (13)

Da sagte ich: Ja, mein Herr!

Er sagte: Seine Bedeutung ist also *musallaṭ* (d.h. machtbegabt), wegen seiner Gewalt und der Macht, mit der es ausgestattet ist.

Da warf ich mich zur Erde nieder. Er sagte: Würde dein Neigen und Niederwerfen mir gelten, so wärest du schon dann einer, der sein Ziel erreicht hat. Schon deine früheren Väter haben sich vor mir niedergeworfen. Wenn du dich aber, o JĀBIR, vor mir neigst, **so neigst du dich in Wirklichkeit vor dir selbst,** und nur Gott noch ist erhabener als das.

Ich aber beugte mich immer noch. Da sagte er: Bei Gott, **JĀBIR, all das braucht du nicht!**

Ich sagte: Du hast recht, mein Herr.

Und er: **Ich weiss ja, was du willst und du weisst, was ich will! So sei am Ziel deiner Wünsche!**

Ich aber verzeichne dies in meinem Buche vom Uebergang aus der Potenz in die Aktion». *(Daselbst, p. 58 der Handschrift).*

Betrachten wir zuerst kurz jene Erzählungen, in denen von JĀBIR's wissenschaftlicher Tätigkeit die Rede ist. Ganz abgesehen von den unmöglichen Wunderheilungen und alchemistischen Verfahren, ist ihr Stil schon auffällig. Wenn JĀBIR von der märchenhaften Schönheit der Sklavin redet, wenn die Gespräche in solcher Breite wiedergegeben werden, so erinnert das alles an den Stil von Tausend-und-eine-Nacht. Und wenn einige Zeitgenossen JĀBIR's, wie die drei Barmakiden KHĀLID, YAḤYĀ

(13) Das aus dem griechischen τέλεσμα entlehnte *ṭilasm* wird als Umkehrung des arabischen *musallaṭ* (machtbegabt) etymologisiert.

und JA'FAR und Mitglieder der Familie YAQṬIN zu Worte kommen, so kann mit diesen scheinbar genauen Angaben die Echtheit der Erzählungen nicht gerettet werden. Sie gehören notwendig zum Kolorit der JĀBIRlegende, und die gleichen Leute spielen gerade in den islamischen Volkserzählungen eine grosse Rolle. Gerade die angeblich autobiographischen Berichte tragen also den Stempel der Unechtheit auf der Stirne.

Viel weitere Schlüsse erlauben die Angaben über die Beziehungen JĀBIR's zu seinem Meister JA'FAR, ganz besonders die zuletzt mitgeteilte Erzählung. Hier kommt die mystische Einheit zwischen JĀBIR und JA'FAR in einer Form zum Ausdruck, wie sie niemals im 8. Jahrhundert möglich gewesen wäre. JĀBIR steht hoch über allen anderen, die den Meister verehren ; er ist mit ihm eins und wenn er sich vor ihm neigt, so neigt er sich in Wirklichkeit vor sich selbst. Der Satz : « Du weisst, was ich will und ich weiss, was du willst », ist nur eine Variation des gleichen Gedankens und kommt formal dem Ausspruch des Mystikers ḤALLĀJ (gest. 923) gleich : « Ich bin der, den ich liebe, und der, den ich liebe, der ist ich ! » Der Unterschied besteht nur darin, dass der von ḤALLĀJ Geliebte Gott ist, mit dem er die mystische Vereinigung erfährt, während JĀBIR von seinem Meister, dem *Imām*, zu dieser höchsten Stufe emporgehoben wird. Dieser Unterschied ist aber ein grundlegender. Nur in der Ismā'īlijja tritt der Imam an die Stelle der Gottheit und nur aus ihren Anschauungen ist eine solche Erzählung zu begreifen.

Vielleicht gibt aber diese Erzählung auch einige Schlüsse über den Verfasser der JĀBIRschriften an die Hand. Meine früheren Untersuchungen ergaben, dass der Verfasser mit seinen naturwissenschaftlichen Lehren isma'ilitische Agitation verbindet. Wir wissen ferner, dass die isma'ilitsche Bewegung eine sehr straffe Geheimorganisation hatte, in der die einzelnen Missionare je nach ihren Einweihungsgraden verschiedene Stufen einnahmen. (14) Aus der umfassenden Gelehrsamkeit und dem wohlberechnenden Takt, mit dem der Verfasser seinen Lesern die isma'ilitischen Lehren nahelegt, müssen wir schliessen, dass er in dieser Organisation einen hohen Rang einnahm. Es scheint nicht zu gewagt,

(14) *Jahresbericht*, S. 39.

wenn wir das Verhältnis seines JĀBIR zum Imam JA'FAR auf ihn selbst und **seinen** Imam deuten. Erst in diesem Licht erhält die Erzählung ihren eigentlichen Sinn. Oft ist in der isma'ilitischen Literatur die Rede davon, dass der oberste Missionar, der Dā'ī, mit dem Imam in einer mystischen Einheit lebt und in bestimmten Fällen der Geist des Imam in ihm lebendig wird. Wir dürfen danach wohl den Verfasser der JĀBIRschriften als eine der wichtigsten Persönlichkeiten in der isma'ilitischen Bewegung des beginnenden 10. Jahrhunderts ansprechen. Leider erlauben die verschütteten Quellen bis heute noch nicht, sein Geheimnis zu durchdringen.

(Berlin) PAUL KRAUS.

An unidentified work by Giovanni da' Fontana : Liber de omnibus rebus naturalibus

In 1544 there was printed at Venice by OCTAVIAN SCOT under the name of POMPILIUS AZALUS of Piacenza a work on all natural things contained in the universe, whether celestial or terrestrial or mathematical, and concerning the angels and movers of the heavens. The work is listed by GRAESSE, (1) but not by BRUNET. There is a copy in the British Museum (2) and another at the Bibliothèque Nationale. (3) There appears to be no other edition of the work, and I know of no manuscript of it.

The work is dedicated to the Emperor, CHARLES V, in the preface to whom the captivity of FRANCIS I at Pavia is mentioned, and who appears to have asked AZALUS to write on natural phenomena. In modern works on CHARLES V, however, there seems to be no reference to AZALUS and his book. He represents himself in the preface as both a university lecturer upon medicine and a practicing physician, and as further burdened with the load of a family and sons. He apologizes for his lack of eloquent and elegant diction, an amenity which his adverse fortune and occupation with other arts have prevented him from acquiring. Perhaps this is the reason why his name does not appear in histories

(1) JEAN GEORGE THEODORE GRAESSE, *Trésor de livres rares et précieux*, Dresden, 1859-1869, 7 vols. A recent sales catalogue therefore does not seem wholly justified in describing our book as « resté inconnu à tous les bibliographes. »

(2) AZALUS (POMPILIUS), *Liber de omnibus rebus naturalibus quae continentur in mundo; videlicet coelestibus et terrestribus necnon mathematicis et de angelis motoribus quae coelorum*, Venetiis, 1544. fol.

(3) *Liber* POMPILII AZALI, *Placentini, de omnibus rebus naturalibus quae continentur in mundo, videlicet coelestibus et terrestribus necnon mathematicis ,et de angelis motoribusquae (sic) coelorum*, Venetiis, apud OCTAVIANUM SCOTUM D. AMADEI, 1544. In-fol. 142 leaves. I have used this copy.

of Italian literature or in such a specialized work on the literary history of Piacenza as that of POGGIALI. (4) Nor is it found in such other historical works on Piacenza as I at present have access to. Only in histories of medicine is he mentioned and there very briefly. DE RENZI credits him with an interest in botany and cites HALLER's *Biblioteca Anatomica* for his interest in anatomy. (5) But this is very likely nothing more than inference from the title of the work ascribed to him. Since he treated « of all natural things », surely he must have included herbs and human anatomy.

We need not worry ourselves overmuch as to who POMPILIUS AZALUS was, since he was certainly not the author of the work before us or perhaps even of its preface or at least not of all of it, nor, so far as we know, was he the author of any other work. He therefore is of no interest to us as an author but only either as a gross liar himself or the invention of an unscrupulous publisher or possibly as the victim of circumstances. But to continue with the preface, in which AZALUS is still supposedly speaking. He says that if his work is not just what the emperor had expected, at least it will be so plainly set forth that it can be understood without further explanation at first reading. His understanding is that the emperor does not want new doctrine but a collection of previous authorities in one volume. He dwells, however, upon the labor to which he has been put in its composition and further expresses his hatred of those who plagiarize the works of others and suppress the authors' names.

The preface then turns to the plan of the ensuing work and states that it wanders as it were over the whole world and is divided into five parts. The first treats of the parts of the world, their order, and the sites of those which are not manifest to the eye, with many theological and philosophical questions annexed. The second part is especially concerned with the orbs of the sky, the planets and their various movements and properties. The third part deals with the four elements and such related phenomena as winds. The fourth part discusses the habitable world, its

(4) C. POGGIALI, *Memorie per la storia letteraria da Piacenza*, Piacenza, 1789, 2 vols.

(5) SALVATORE DE RENZI, *Storia della medicina italiana*, Napoli, 1849, 2nd ed., 5 vols., III, 98 and 287.

divisions, and the effects of the heavens upon different longitudes and latitudes. The fifth part is about the quantities (qualities?) of the elements of the heavens and stars, and of the marvelous things in any sphere of things active and passive, forsooth, air, fire, water, and earth, and various minerals, plants, and animals. This program, with its strong flavor of astrology, is fairly well carried out in the subsequent text, so that one suspects that this concluding portion of the preface is from the pen of the author of the text and not of POMPILIUS AZALUS, whose warning to CHARLES V that he would find the ensuing work different from his expectation we are now to find amply justified.

For the text bears unmistakable and frequent signs of being the work of an Italian author of the previous century and not of POMPILIUS AZALUS at all. Moreover, this author lived in the earlier part of the fifteenth century. He speaks of PAUL OF VENICE who died in 1429 as having once been his preceptor in the liberal arts, and marvels that PAUL, Augustinian Eremite as he was, should have adhered to the opinion of AVERROES rather than to that of AUGUSTINE (6). BLASIUS OF PARMA (BIAGIO PELACANI) (7) who died in 1416 likewise was at one time our author's teacher (8) and used to tell of a reflection of the Milanese army in the sky

(6) Edition of 1544, fol. 2v. After arguing against the doctrine of the unity of the intellect as diabolical and erroneous, our author says: « hic admiror permaxime de PAULO VENETO ordinis Haeremitarum Sacrae Theologiae doctore olim in artibus praeceptore meo qui huic AVERROIS opinioni plurimum adhaeserit et non verissimo sanctissimoque Patri suo AUGUSTINO. Nemo certe ita sapiens est qui quandoque non descipiat. »

(7) F. AMODEO, « Appunti su BIAGIO PELICANI da Parma. » *Atti del IV Congresso Internazionale dei Matematici*, III, Rome, 1909, 549-553, held on the basis of early printed editions that the name should be spelled PELICANI rather than PELACANI, but is in disagreement with TIRABOSCHI, with AFFÒ, *Memorie degli scrittori e letterati Parmigiani*, 1789, II, 166-168, and with the university records of Pavia as published by MAIOCCHI, *Codice diplomatico dell'università di Pavia*, Pavia, 1905. In a manuscript at the Bodleian, Canon, Misc. 422 ,15th century, fols. 1-52, we read: « Explicit Summa super libro de celo et mundo compilata per famosissimum artium doctorem magistrum BLAZIUM DE PARMA DE PELACANIIS. » At the Vatican, in Ms. Barberini Latin 357, 15th century, fols. 61-107, is found the spelling, « BLAXIUM DE PELLECANIS, » but I know of no Ms. with AMODEO's spelling.

(8) Edition of 1544, fol. 41v (II, 10): « Recitat tamen BLAXIUS PARMENSIS doctor meus quod aliqui sapientum non attribuunt coelo lunae istum quintum motum... Sed ego simul cum prefato doctore meo salva pace illorum credo quod celum lunae non sit excerptum ab ipso motu. »

which he had seen in 1403 (9). Our author further refers to « our friend, » PROSDOCIMO OF PADUA, who had drawn up some of the most recent astronomical tables. (10) Undoubtedly this was PROSDOCIMO DE' BELDOMANDI, noted writer on astronomy, mathematics, and music, who died in 1428.

In the text, moreover, someone is addressed a number of times in the second person who is certainly not the emperor, CHARLES V, but whom the author calls « my son », and in one place, « My OCTAVIAN. » (11) In another passage he states that, as he was about to terminate the section of his work dealing with images in the heavens, there came to him as he was writing a studious youth who wished to know further why the ancients so often conceived the constellations in human or animal form. (12).

Furthermore, our author indulges in certain definitely dated personal reminiscences. He recalls the damage wrought on August tenth, 1410, by the worst wind in all the history of Venice. (13) He tells how « a certain man of subtle genius and invention who constructed an instrument in 1416 called The Mirror of the Planets thought that the sun had an epicycle but

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(9) *Ibid.*, fol. 75r : « Recitat enim BLAXIUS PARMENSIS olim doctor meus semel apparuisse tempore suo anno gratiae MCCCCIII in Lombardia iuxta castrum quod dicitur Buxetum per tres dies omni die ante horam tertiarum in nubibus equites et pedites armatos. »

(10) *Ibid.*, fol. 35v (II, 3) : « PROSDOCIMUS PATAVIUS amicus noster qui novissimas tabulas instituit. »

(11) *Ibid.*, fol. 31v, « Nollem tamen, fili mi, ad has artes quas ecclesia prohibet te avertas »; fol. 35v, « Sed adverte, fili mi... »; fol. 41r, « Tu quoque, OCTAVIANE mi, priusquam finem libro imponam, operis coelestis fabricam intelliges esse mirandam »; fol. 66v, « Nec credas hoc, fili mi, esse impossibile vel fabulam poetarum. »

(12) *Ibid.*, fol. 28v : « Volebam finem hactenus imposuisse sermonibus de imaginibus supercoelestibus, putans quantum ad propositum opus explicare decreveram satis dixisse. Sed mihi scribenti supervenit quidam studiosus adolescens cupidus ulterius scire cur veteres has formas hominum et animalium magis quam aliorum in coelo conceperint... Nec tibi displicebit, ut opinor, heac prolixitas qui poetarum libros legis. »

(13) *Ibid.*, fol. 71r, « Et ipse memor sum anno ab incarnatione domini nostri M.CCCC. decima die mensis Augusti qua celebratur festum beatissimi Laurenti... » Thus the edition gives the date as 1400, but probably a « X » or « decimo » has been omitted by confusion with the « decima » for the day of the month which immediately follows. Concerning the storm of August 10, 1410, see HAZLITT, *The Venetian Republic*, I (1915), 813; SABELLICO, *Degl'Istorici delle cose Veneziane*, Venice, 1718, II, IX, 463.

no deferent », a view of which our author disapproves. (14) Our author was once sent by the Doge of Venice to Brescia to visit the great condottiere, Count CARMIGNUOLA, then captain general of the Milanese army, who was born in 1390 and died at Venice on May 5, 1432. (15) He comes down to a much later date when he states that in the Jubilee year of 1450 the *aux* of the sun was in the first degree of Cancer. (16)

Such passages as we have been listing are both too numerous, too disseminated throughout the work, and in some cases too closely associated with the opening of chapters, to make it possible to account for them on the theory that AZALUS might have crudely stitched together excerpts from another author or authors without expunging anachronistic personal allusions. Moreover, they are all evidently by one and the same person, whose connection is with Venice rather than Piacenza and whose period is the first half of the fifteenth rather than of the sixteenth century. Finally, it is clear from a reading of the text that it is not a medley or adaptation of one author's work by another, but all in one style and from one pen. To all appearances a work which faithfully reflects the thought and conditions of the middle of the fifteenth century has been printed unchanged in the middle of the next century.

Either, then, the dedication of POMPILIUS AZALUS, by some slip of the printer, was attached to the wrong text and table of contents, or AZALUS, despite his professed abhorrence of plagiarism, made a most bare-faced and inept attempt to pass off as his own labor and the sweat of his brow a work which is manifestly not his own. Perhaps he figured that CHARLES THE FIFTH would never look at the book anyway. Perhaps he even failed to examine it at all closely himself. But we do not greatly care what AZALUS

(14) Edition of 1544, fol. 45v : « Hoc loco nolo praetermittere quod quidam subtilis ingenii vir et inventionis compositorque cuiusdam instrumenti quod speculum planetarum appellavit anno domini MCCCCXVI arbitratus est solem epiciclum habere sed non deferentem cum ille sibi supplere videatur locum deferentis. Sed hanc oppinionem non intendo in praesenti ventilare alias fortasse dabitur tempus quo efficacissimis rationibus falsam esse monstrabimus. »

(15) *Ibid.*, fol. 130v.

(16) *Ibid.*, fol. 39v : « Ad principale redeundo propositum dicimus quod anno gratiae millesimo quadragentesimo quinquagesimo quo Iubileum celebravimus inventa est aux solis esse in gradu primo Cancri. »

thought or did. We are more concerned about restoring to the fifteenth century author the work which should have long since been placed to his credit. Who was this citizen of Venice, this pupil and friend of such a celebrated trio in the learning of the early fifteenth century as BLASIUS OF PARMA, PROSDOCIMO DE' BELDOMANDI, and PAUL OF VENICE? He himself gives us the clue by refering to other writings of his. He had addressed a treatise on perspective in painting to the Venetian painter, IACOPO BELLINI, (17) father of GENTILE (died 1507) and GIOVANNI (died 1516) who were also artists. He had composed a work on the solid sphere and another on a most novel instrument, *De trigono balistario*. (18) This last title is decisive. Our author is no other than GIOVANNI DA' FONTANA, hitherto chiefly known as a Venetian writing in the fifteenth century upon military and hydraulic engineering.

Thereby hangs a tale, and with it goes a moral. In 1925, in the department of Queries and Answers in the pages of *Isis*, (7, 105) Dr. GEORGE SARTON, calling attention to the analysis in S. J. VON ROMOCKI's *Geschichte von Explosivstoffe*, I (1895), 231-240, of GIOVANNI DA' FONTANA's album on military engineering with Latin explanations written in cipher (*Bellicorum instrumentorum liber cum figuris et fictivis literis conscriptus*, written about 1420), asked whether any manuscripts were extant of other works by GIOVANNI therein cited: *Libellus de laberintis*, *Libellus de aquae ductibus*, *Tractatus de pisce ave et lepore*. Working at the Vatican library in 1927 I found a *De speculo* ascribed to IOHANNES FONTANA Venetus in a manuscript of the Barberini collection. (19) And in examining QUETIF and ECHARD's *Scriptores ordinis praedicatorum*, Paris, 1719-1721, 2 vols., I found the statement that a JOHN FONTANA of Piacenza about 1420 wrote a moralizing work (Opus in quo multa moralia) somewhat resembling the *Speculum historiale* of VINCENT OF BEAUVAIS. An answer

(17) *Ibid.*, fol. 74v (III, 14): « Ab hac naturali experientia ars pictoria optimos canones accepit ut in libello ad IACOBUM BELLINUM Venetum pictorem insignem certe descripsi. »

(18) *Ibid.*, fol. 36 r: « Ego similiter cum quendam tractatum de spaera solida componerem et aliud de Trigono Balistario instrumento novissimo in similes errores incidi sequens ALFONSI canones et aliorum vestigia. »

(19) Barb. lat. 350, fols. 61-65v, « Cum inferiorum cognitio ad celestium conducat inquisitionem.../... alio modo et commodius videtis. »

to Dr. SARTON's query to this effect was published in *Isis* (13, 103) in 1929. Meanwhile, with the name of GIOVANNI DA' FONTANA fresh in mind, while working at Oxford in 1929 among the Canonicus manuscripts of the Bodleian, I came across a long treatise on the measurement of altitudes, latitudes, and the instruments for this, with accompanying figures, written in 1440 by IOHANNES FONTANUS, a salaried physician of Venice, and entitled, *De trigono balistario*. Concerning this I despatched another answer to *Isis* (14, 221, 1930), and it was this title, when I turned in 1930 to write up the notes taken the previous summer at Paris on the work ascribed to POMPILIUS AZALUS, which suggested its true author. All of which in a sense went back to Dr. SARTON's original query, so that the moral of this long tale is the value of such a department as that of Queries and Answers. Before the query I had noted nothing by GIOVANNI DA' FONTANA; since it I have found two works by him in manuscripts, one in print, citations by himself of yet other writings of his, and a somewhat dubious secondary reference to yet another work. The fact that QUETIF and ECHARD located him at Piacenza suggests that their notice may be to some extent a confused recollection of our present volume, although it is scarcely a moralizing work and resembles the *Speculum naturale* of VINCENT OF BEAUVAIS more than his *Speculum historiale*.

One of the most interesting features of the *Liber de omnibus rebus naturalibus* is the geographical knowledge or conjecture which it displays at a time nearly half a century prior to the voyages of COLUMBUS and VASCO DA GAMA. This is so considerable that a recent sales catalogue, deceived by the supposition that the work was really composed under CHARLES V, interprets two passages as allusions to America. (20) But the *terra incognita* to which GIOVANNI DA' FONTANA refers was neither South nor North America, continents which at that date lay entirely without his ken. He held rather that the Indian Ocean, as we call it, was landlocked, being bounded on the north by India, on the west

(20) « Deux passages se rapportant à l'Amérique se trouvent au feuillet 94 : « Et ab eius occasu finitur pro parte etiam terra incognita etc. » et au feuillet 95 : « Unde ex tribus maximis totius orbius *(sic)* partibus asia coniungitur africae per dorsum arabiae, quem nostrum mare Mediterraneum ab arabico excludit praeterea per terram incognitam quae indicum pelagum cingit terminatur etc. »

by Africa or Ethiopia, on the east and south by unknown land which, however, was in part accessible and through which there was perhaps a passage. (21) He accepted the common theory that there were two chief seas : one the ocean which encircles all the land, the other a sea surrounded by land or the Mediterranean. Only he did not attempt to restrict the second conception to the Mediterranean Sea between Europe and Africa, and between the Straits of Gibraltar and Syria. For him the midland sea was manifold, and the aforesaid Mare Indicum or Arabicum was its greatest member or manifestation. (22) Just as the western Mediterranean had an irregular coastline and was studded with islands, so the Indian Sea had its gulfs and islands, many of which were inhabited. (23)

Nor did FONTANA believe that the southern temperate zone was uninhabited. In his first book, it is true, he set forth the common view in the fourteenth and fifteenth centuries that part of the earth was not covered by water because the earth had two centers, one of magnitude, the other of gravity, and so in part projects beyond the sphere of water. (24) The converse of this view would have to be that the opposite hemisphere of the earth must be so much the deeper submerged. But in a later book FONTANA tells us that recent cosmographers and especially those who owe their information to true experience and distant travel and diligent navigation have found beyond the equinoctial circle to the south a notable habitable region not covered by water and many famous islands. (25) From such

(21) Edition of 1544, fol. 79r (III, 18) : « mare Indicum quod est in latere orientali australi interclusum ex parte sua septentrionali terra Indica et occidentali terra Ethiopica, ex oriente vero et austro terra incognita est pro parte accessibili. De quo nostri ferunt manifestum hostium non habere, sed nos credimus illud habere et aditum esse ad oceanum vel brachium Amphitritis meridionale sed fortasse hominibus ignotum. »

(22) *Idem*, « multiplex est et maximum eorum proprie dicitur mare Indicum. »

(23) *Ibid.*, fol. 94v, « Non aliter dicimus de mari Indico, omne enim cum suis sinibus arabico persico gargetico eoque qui dicitur proprio nomine magnus sinus a terra similiter ex omni parte clauditur. »

(24) *Ibid.*, fol. 11r, I, 10 : « de quatuor elementorum sphaeris et caeli, et quomodo pars terrae remanet ab aqua discooperta »; fol. 11v, cap. 14 *(sic)* : « de vero situ terrae secundum centrum et cur secundum potestatem sit discooperta ab aqua. » Under this heading we read, « Duplex esse centrum in aliquo elemento, unum magnitudinis, alterum gravitatis. »

(25) *Ibid.*, fol. 90r : « Sed qui successerunt cosmographi et proprie qui vera

regions and islands came pearls, silk, and other precious articles of merchandise. (26) Although FONTANA retained the traditional division of the habitable world into seven climes as a matter of customary convenience, he was careful to explain that many inhabited regions and cities lay outside and beyond these zones. (27)

How shall we reconcile these statements of FONTANA? If, despite his acceptance of the doctrine that more than half of the earth's surface must be under water, because of the greater weight of the element earth, he recognized the existence of land in the southern as well as the northern hemisphere, then it would seem that he must have held that the western hemisphere was entirely covered by the ocean. Thus he affirms that it should be believed that there is not any of the zones containing land which is not covered by water and uninhabitable for about half its longitude. (28)

This is a very significant passage and shows that the bearing of this Aristotelian doctrine of heavy and light as applied to the spheres of earth and water has not been realized with reference to the problem of sailing west and the voyage of COLUMBUS. From what FONTANA says it is evident that the Venetians of the middle of the fifteenth century had considerable knowledge of the Indian Ocean and adjoining regions south of the equator. But this very establishing of the existence of habitable land in the southern hemisphere would make a scientist of the time, who held the general belief that earth was heavier than water and that the sphere of earth was surrounded by a sphere of water, the more inclined to believe that there was no land in the western hemisphere. Such a scientist would discourage his fellow Italians

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experientia et peragratione itinerum et diligenti navigatione certiores facti sunt invenerunt ultra circulum equinoctiali suppositum versus Austrum esse partem notabilem habitabilem ab aqua discooperta et insulas multas atque famosas. »

(26) *Idem*, « Nec est omnino illa zona inter torridam et extremam Australem inhabitabilis ex quibus insulis et partibus ad nos deferuntur optimata omnis fere generis et margaritae gemmae pulcherrimae et sericum et multa pretiosa. »

(27) *Ibid.*, fol. 96r : « Post vero multa secula multae gentes incoluerunt partes plurimas extra climata praedicta et fabricate sunt civitates innumere et notae factae sunt et famosae ita ut non tantum ex clima septem versus septemtrionalem sed ultra primum sub equinoctiali et ultra, ut ante intellexisti, de quibus multa narrantur in cronicis et historiis gesta memoriae digna. »

(28) *Ibid.*, fol. 90r : « Et credendum est quod non sit aliqua ex zonis predictis terrae quae secundum fere medietatem longitudinis eius non sit ab aqua cooperta et inhabitabilis. »

from westward enterprises, and possibly the Portuguese, when they found that the west coast of Africa extended south of the equator, would take the same view, although their discovery of islands out in the Atlantic would have a corrective effect. Empirical observations of fishermen and traders might lead to new truth, but the accepted scientific hypothesis tended to discourage discovery. And this raises the serious question whether scientific hypotheses, although highly esteemed by many, do not, like historical generalizations, tend to accomplish more harm than good. What we need are more facts, to find a few more islands in the ocean of mystery.

Whence did FONTANA obtain his knowledge of distant lands? Probably it was in large measure due to his connection with Venice, the great trading power of the time. He has much to say about the Great Khan, and uses the works of thirteenth century travelers like MARCO POLO and ODORIC, or more recent writers like JOHN ANGLICUS (MANDEVILLE?) and NICHOLAS OF VENICE (NICCOLÒ CONTI?). A less familiar contemporary named by him is CONSTANTINE OF VENICE, a faithful friend of his who had traveled for many years through the empire of the Great Khan. (29) Sometimes such friends regaled him with tales of doubtful veracity. He heard from many merchants who were dear friends of his « and trustworthy » that they had seen in the river Tanais (Don?) and in other streams of Asia aquatic animals which seemed human in form but were really fish. (30) To investigate whether deep sea water was sweet he had constructed a vase for the Venetian patrician, MARCO LIPPOMANO, to drop overboard, but it was never tried out. (31) Despite his knowledge of the earth's surface, he held to the belief that hell was situated within the earth. (32) Those who expressed doubt as to tales of other lands and gave themselves neither to study nor travel he chided as idle stay-at-homes like an ass in its stable or a cow nourished in a courtyard. The best way for such a person to

(29) *Ibid.*, fol. 119r, « CONSTANTINUS VENETUS mihi fidelis amicus qui plurimis annis per regna magni kan peragravit multa similia se vidisse retulit. »

(30) *Ibid.*, fol. 125v, « Audivi a multis mercatoribus amicis meis carioribus et fide dignis se vidisse in Tanay flumine... »

(31) *Ibid.*, fol. 81v (III, 19).

(32) *Ibid.*, fol. 83v.

discover his ignorance would be to pay a brief visit to some adjoining region. « And most assuredly he will find there some differences and novelties, either in the idioms of the language, or in human *mores*, or in the manner of living or costume, or in the arts and crafts, or in variety of plants or fruits or birds and beasts differing from his own province. » (33) And how much more is this the case with a really distant land.

GIOVANNI DA' FONTANA was proud of the improved knowledge of the weather and of the map-making of his age. Prevailing winds, islands, promontories, gulfs, rocks, shoals had all been charted. (34) This is a noteworthy literary reference to the excellence of the portolan charts which sailors of the Mediterranean had been using and making since at least 1300. FONTANA also was proud of the mechanical progress and invention of the later medieval period, and spoke of almost the entire habitable world being full of magnificent fabrics, ingenious machines, and organic instruments for carrying on the arts or operative sciences. (35) From this it is something of a descent to the old story of remedies learned from observing animals heal themselves therewith. Despite the fact that FONTANA was himself the author of an illustrated work on instruments of war, he represents as the invention « of impiety no less than genius... the horrid machine

(33) *Ibid.*, fol. 142v (the last page of the work): « Si quis talium voluerit suam cognoscere ignorantiam, parum per se a domo discedat et ad aliquam proximam transferat regionem. Et certissime inveniet ibi aliquas differentias et novitates vel in linguarum idiomate vel in moribus hominum vel in modo vivendi vel in habitu corporis vel in artificiis et operibus vel in herbarum diversitatibus vel fructuum vel in volatilium aut quadrupedum differentia aliter quam in propria provincia. »

(34) *Ibid.*, III, 7 (the numbering of the folios here becomes a little confused): « Navigantes autem cautiores facti et experti multa naufragia atque maris pericula evaserunt (cum facile sit inventis agere et superfactis consulere) ventorumque ortus et differentias adiunxerunt et nostris etiam temporibus communiter observatur... Igitur multiplicantes situs et aspectus ventorum ad loca quaecumque maritima precisius atque tutius navigant per illos signantes insulas promontoria sinus scopulos siccas subaqueas et ripareas ut quae voluerint accedere vel evitare facile possint. Gaudent enim naucleri et portulani ventorum plurimum in suis mappis vel cartis et stellis nauticis descripta. Paucitate vero eorum antiquitus formidabant et saepius periclitabantur in mari. »

(35) *Ibid.*, fol. 110v, « Totus enim fere habitabilis orbis fabricis illustratur magnificis, ingeniosis machinis plenus est et organicis instrumentis de quibus scientiae operativae quas artes vocamus. »

which we call a *bombarda.* » But he marvels that so much force is generated by a weak powder. (36)

Interesting, if true, are some of FONTANA's statements and anecdotes concerning his own times. A « trustworthy » person had told him that when he attended the University of Paris, it had fifty thousand students and more than sixteen thousand colleges and boarding-houses. (37) When on the mission to CARMIGNUOLA, he heard rustics tell of men who ate the little children of their enemies. (38) A Venetian left orders that he be buried in the wall, and a man at Padua, while FONTANA was a student there, insisted upon burial with joy and gladness rather than mourning. (39) When Venice during a war ran short of gold and silver, the government stamped leather and ordered it to be accepted as legal tender for a few days, when gold and silver would again be given in exchange. (40)

Besides those late medieval writers who had been his own friends or teachers, like BLASIUS OF PARMA, PAUL OF VENICE, and PROSDOCIMO DE' BELDOMANDI, FONTANA cites such names from the preceding century as GIOVANNI DE' DONDI, IOHANNES DE LINERIIS, (41) and PIETRO D'ABANO. The theory of AZARCHEL (AL-ZARKALI) and THEBIT of access and recess to explain the movement of the eight sphere was in FONTANA's opinion a subtle invention which avoided the necessity of a vacuum or the penetration of one body by another. King ALFONSO followed it in his Tables, and JOHN DE DONDIS and many others observe it at present. But FONTANA prefers to it the explanation given by PETER OF ABANO in his *Lucidator* and treatise on the movement of the eight sphere. (42) He mentions 1310 as the date of these

(36) *Ibid.*, fol. 111v, « Ex quibus est orrida machina quam bombardam appellamus ad diruendam omnem fortem duritiem etiam marmoream turrem non minus impietatis quam ingenii fuisse existimo qui primo adinvenerit... tantam vim habeat a pusillo pulvere. »

(37) *Ibid.*, fol. 112r, « Audivi a fide digno quod cum ibidem esset etiam illo tunc temporis in illius studio scolares erant quinquaginta millia et plusquam sexdecim millia hospitium collegia. »

(38) *Ibid.*, fol. 130v.

(39) *Idid.*, fol. 133v-134r.

(40) *Ibid.*, fol. 136r.

(41) *Ibid.*, fol. 35v, « IOANNES DE LINERIIS quamvis acutus arismetra... »

(42) *Ibid.*, fol. 34v : « ... hanc sequutus est rex ALFONSUS in suis tabulis et multi antiquorum tabulistarum et IOANNES DE DONDIS Patavius et plurimi hodiernis

two treatises which is, indeed, the date given in their texts. FONTANA also accepts PETER OF ABANO's astrological doctrine of alternating periods of advance and decline in civilization as the movable and immovable zodiacs of the eighth and ninth spheres coincide and separate. (43) Reference is made to a student of perspective who had stated that the utmost radius of a rainbow was forty-four degrees, and that therefore a rainbow could not be seen when the sun was more than forty-four degrees above the horizon. (44) But his name is not given. FONTANA repeats the comparison of the universe to a mechanical clock which God had set running which we find in writers like NICOLAS ORESME of the fourteenth century who accepted JEAN BURIDAN's theory of impetus. FONTANA himself does not go quite that far but retains the blessed angels as moving intelligences. (45).

JOHN OF SACROBOSCO is criticized for having held that a lunar eclipse could never be visible throughout the inhabited region of the globe. (46) But FONTANA agrees with him that the eclipse of the sun at the time of the crucifixion could not have been natural for the reason that the moon was then in its fourteenth day and beneath the horizon in the southern hemisphere in opposition to the sun, and so could not interpose between sun and earth. (47) MICHAEL SCOT and ALBERTUS MAGNUS are other thirteenth century authors cited, and that for such incredible stories as those of men with three eyes or of the men of India or Ireland who grow so old that they ask to be taken to some less salubrious climate in order to be able to die at last. (48)

Not only did FONTANA affirm that God had entrusted to angels

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temporibus observant sed non legerunt opinionem quam veram iudicamus quae fuit PETRI physici medici et in arte astrorum clarissimi sive ex proprio ingenio sive ab alio accepit in suo lucidario astrologico eam ponit atque particularem tractatum de motu octavae descripsit quem ad propositum ordinavit per efficacissimas rationes naturales et verissimas experientias reprobans omnes opiniones eorum qui tales motus accessus et recessus cum reiteratione eorum crediderunt. »

(43) *Ibid.*, fol. 36r-v.

(44) *Ibid.*, fol. 75v (III, 14).

(45) *Ibid.*, fol. 41r (II, 9) : « O mirabilis sapientia divina quod tam nobile horologium aedificavit et mirabiliter moveri iussit per benedictos angelos ministros suos ! »

(46) *Ibid.*, fol. 59v (II, 33).

(47) *Ibid.*, fol. 59v (II, 37).

(48) *Ibid.*, fols. 117v, 140v; see also the story from ALBERTUS at fol. 124v.

the task of running the clock of the world; he also displayed an inclination towards that type of astrological necromancy which there is some reason to suspect had brought Cecco d'Ascoli to the stake, and towards *Ars notoria* which was often condemned by the orthodox as a forbidden occult art. In a chapter on the blessed angels who dwell in the twelve signs of the zodiac he states that the first makes a man perfect in his life with no fear of damnation; the second, which has a form like a child of three years, enriches men; the third confers power over brothers and kindred and floods; and so on. (49) Exorcists are able to summon these spirits, one of whom has the form of a dove bearing a crown of twelve precious gems on his head and in his mouth a green laurel leaf folded in the sign of the cross. This angel instructs one in geomancy, theology, and mathematical science. The spirit or spirits of the ninth sign or Altitude are able to transport men very swiftly from province to province. Blessed is the man who rises to such merit that he can call and converse with such spirits. « Nor think, my son, that this is impossible or of the fables of the poets. » (50)

The Notory Art admonishes man what sort of life he must lead in prayer and fasting, in chastity and purity of heart, in devotion and faith, and what modes and times and places he must observe, if he wishes to summon to himself some angel from those blessed Intelligences. If they appear to wicked men, it is only to deceive them, but they are coerced by holy exorcists through the virtue of God. Although sometimes they are coerced by philosophers and students of the arts, they do not appear because of the sanctity of such persons' lives but because of their faith and the virtue of the characters and divine names which they employ, which we believe God revealed to Adam while he was still in a state of innocence, and which Adam afterward communicated to his sons. (51)

Although stars are lacking in the ninth sphere, the sages say that characters and outlines of images not apparent to us are present there, including the twelve signs of the zodiac and many

(49) *Ibid.*, fol. 66r.
(50) *Ibid.*, fol. 66v.
(51) *Idem.*

other occult emblems of numerous properties and virtues. The astronomers of Persia and India even say that some of these can be seen by very keen vision at certain seasons on very clear and quiet nights from mountain tops and by those to whom it is conceded or revealed. They attribute these characters to the angels of the spheres of the planets and the stars. Experimenters engrave such characters or names of angels and constellations on metals, or make seals in wax or gum, or paint images of various forms and materials. HERMES, ENOCH, TOC, AARON, EVAX, SALIMANANCHUS, ZENO, ZAEL, PTOLEMY and many Greeks were authorities concerning such images and wrote on the *Ars notoria*. « And we read that in the region of the damned are found characters and infernal figures and names of the chief devils for forming images to promote lust, discord, secret homicide, to spread disease », and for other bad ends. Not good angels but astute devils revealed them to men in the abominable art of magic. Many are found in writings on fascination, among the authors of which FONTANA names VIRGIL and PETER OF ABANO. God forbids the manufacture of such images but witches employ them. (52) Some persons think that those images which work against poisons, diseases, fire, thunderbolts, and other ills, or which confer wisdom, eloquence, and concord, are not to be condemned but have an astrological and natural basis and were revealed to men by angels as remedies. But FONTANA concludes that it is safer to omit both kinds since they are hard to distinguish. (53) Some pages later he states that some believe that the names of the mansions of the moon are those of angels deputed to those places, for each mansion has its own characters and peculiar influence, and experimenters are wont to form images or to begin new undertakings when any planet but more especially the moon enters them. (54) Thus experimenting is connected a second time with magic and occult arts. But FONTANA warns

(52) *Ibid.*, fol. 26r, « has fieri semper prohibuit Deus sed iubent malefici. » The preceding discussion occurs on the same page in the chapter (I, 26), « De caracteribus sphaerae nonae et (con) stellationibus. »

(53) *Idem*, « Cum vero similium characterum descriptiones variae sint et pictorum errore atque scriptorum corruptae habeantur et ad corrigendum nullam regulam invenio. »

(54) *Ibid.*, fol. 33v.

his son to have nothing to do with these arts which the church prohibits. (55) Anent pyromancy he remarks in another passage that certain *Piromantici*, who wish to make prognostications from haloes and other appearances of colors of that sort, incorrectly assume that they are in the sky. (56) He alludes to certain activities of the alchemists without expressing disapproval, as when he speaks of their artificial waters or their producing flames of different colors. (57)

Such is the combination of science and superstition, of credulity and correct information in this work by GIOVANNI DA' FONTANA. It will perhaps repay a more detailed study than I have as yet had the time and opportunity to give to it. The primary purpose of the present treatment has been to restore a hitherto unidentified work to its proper author and period and to give some notion of its importance rather than to attempt an exhaustive exposition of its content. It certainly gives us a new insight into the back-ground of the later voyages of discovery including those of COLUMBUS to America.

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New York.

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(55) *Ibid.*, fol. 31v.

(56) *Ibid.*, fol. 77r (III, 17): « Qui vero alonem et huiusmodi apparentias colorum esse in coelo putant male iudicant (ut quidam Piromantici ex hiis coloribus volentes ferre pronostica) licet ibidem esse appareant. »

(57) *Ibid.*, fols. 75v and 79v (III, 15 and 19).

John Mayow
In contemporary Setting *

A Contribution to the History of Respiration and Combustion

§ 1. JOHN MAYOW furnishes an extraordinary instance of a scientist whose reputation has increased enormously since his own day, and particularly in recent years. In his short life-time he published two books, the *Tractatus duo* in 1668 and the *Tractatus quinque* in 1674, which, although they undoubtedly came prominently before the scientific world, had very little effect in moulding the views of his contemporaries or his immediate successors. But, after the discovery of oxygen by SCHEELE and PRIESTLEY, and its correct interpretation by LAVOISIER, several people happened upon MAYOW's books lying dusty and forgotten on various library shelves (1), and appear to have read them with astonishment, in the light of the new views which were beginning to find acceptance.

§ 2. The earliest, or one of the earliest, of such references occurs in an English translation of SCHEELE's *Chemical Observations and Experiments on Air and Fire, (London, 1780)*, the translator, J. R. FORSTER, saying in a note (p. XIII) that MAYOW « has already given some obscure hints about that part of our common atmospherical Air, which properly speaking is the most proper for respiration » (2), but he thinks MAYOW's proofs to have been so little convincing that he can have no claim to the

(*) The translation by CRUM BROWN and DOBBIN of MAYOW's *Tractatus Quinque (Medico-Physical Works of John Mayow, Alembic Club Reprints, No. 17. Thin, Edinburgh 1907)*, which is easily available, will be referred to in the sequel under the abbreviation *M.*

(1) A fact which seems to show that they had a fairly wide circulation; but see quotation from GRIMAUX, § 3.

(2) MAYOW, as will be explained later (§ 123), did not seem to consider it, *per se*, suitable for respiration at all.

discovery of dephlogisticated air. « It is only curious, that a loose hint, thrown out at random in that age, should at such a distance of time in a new, more circumstantial and ample manner be confirmed in a series of experiments by two philosophers [SCHEELE and PRIESTLEY] who certainly knew nothing of MAYOW. » (3) (p. XIV).

§ 3. It is possible that this note of FORSTER's was brought to LAVOISIER's attention soon after his elucidation of the rôle of oxygen, for GRIMAUX (*Lavoisier*, 1888, p. 107, note 1) says, « Quand, après les découvertes de LAVOISIER, on lui opposa MAYOW dont il n'avait jamais entendu parler, il chargea son ami MAGELLAN, qui habitait Londres, de lui procurer le livre du savant anglais. MAGELLAN s'adressa en vain à tous les libraires de Londres; il lui fut impossible de trouver un exemplaire des œuvres de MAYOW. (Lettre de MAGELLAN à M^me^ LAVOISIER.) »

§ 4. The next writer to take some notice of MAYOW was BLUMENBACH in his *Institutiones Physiologicæ* of 1787, p. 114, who is quoted by BEDDOES, Preface p. XXXVIII (see on §§ 5, 6) and by YEATS, p. 234, note, (see on § 9) as having read and re-read MAYOW's tractatus of 1674 with great pleasure. (4)

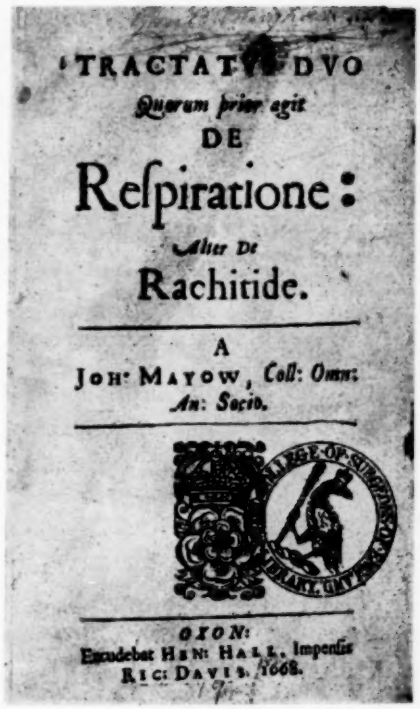
§ 5. In 1788 EDMUND GOODWYN, M. D., published a work on *The Connexion of Life with Respiration etc.* Some correspondence relating to this book seems to have stimulated THOMAS BEDDOES, then Reader in Chemistry at Oxford, who was aware of MAYOW's works, to write : ***Chemical Experiments and Opinions. Extracted from a work published in the Last Century. Oxford, Clarendon Press***, 1790. (5) (One plate is given as frontispiece; it is Tab. 5 of the 1674 edition of the *Tractatus Quinque* and of A. C. R., No. 17).

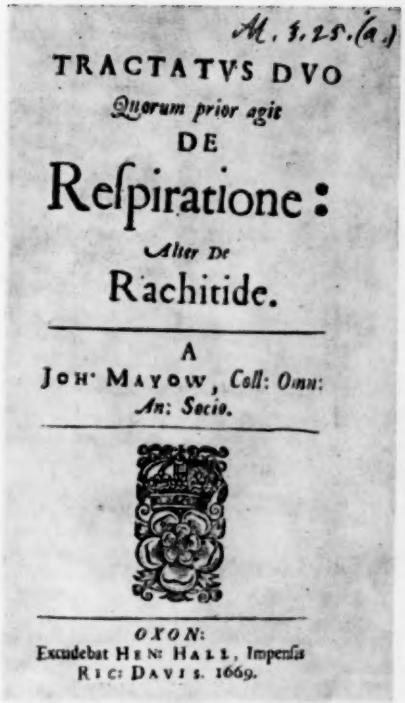
§ 6. The name of the author does not appear on the title page, but is signed at the end of a long preface, pp. I-XLI, addressed to GOODWYN, and dated ***Oxford, February*** 12, 1790.

(3) PRIESTLEY had undoubtedly read HALES' *Statical Essays* in which MAYOW is mentioned more than once. (See § 19, note).

(4) In the second edition of BLUMENBACH's *Institutiones* (*Göttingen*, 1798, p. 115) this passage is dropped, but in connection with the difference in colour of arterial and venous blood reference is made to p. 104 of J. ANDR. SCHERER's *Beweiss, dass* J. MAYOW *vor* 100 *Jahren den Grund zur antiphlogistischen Chemie und Physiologie gelegt hat.* (*Vienna*, 1793).

(5) A short notice of BEDDOES' book was published in ROZIER's *Journal de Physique* for August, 1790, vol. 37, p. 154 with the four figures given by BEDDOES.


TRACTATVS DVO
Quorum prior agit
DE
Respiratione:
Alter De
Rachitide.
A
JOH: MAYOW, Coll: Omn:
An: Socio.
OXON:
Excudebat HEN: HALL, Impensis
RIC: DAVIS. 1668.


M. 5. 25. (a.)
TRACTATVS DVO
Quorum prior agit
DE
Respiratione:
Alter De
Rachitide.
A
JOH: MAYOW, Coll: Omn:
An: Socio.
OXON:
Excudebat HEN: HALL, Impensis
RIC: DAVIS. 1669.

Isis, XV, pl. 1

T. S. PATTERSON

FIG. 1. Title page of Mayow's *Tractatus duo* of 1668. From the Library of the Royal College of Surgeons of England. In the original the line below the word *Rachitide* is 61 mm. long.

FIG. 2. Title page of Mayow's *Tractatus duo*, dated 1669. From the Hunterian Library of the University of Glasgow. Same size as the title page of 1668.

UNIV. OF MICH.

TRACTATUS QUINQUE
MEDICO-PHYSICI.
Quorum primus agit
DE SAL-NITRO,
ET
SPIRITU NITRO-AEREO.
Secundus
DE RESPIRATIONE.
Tertius
DE RESPIRATIONE FOETUS
IN UTERO, ET OVO.
Quartus
DE MOTU MUSCULARI,
ET SPIRITIBUS ANIMALIBUS.
Ultimus
DE RHACHITIDE.

Studio
JOH. MAYOW LL. D. & *Medici*:
Necnon Coll. Omn. Anim. in Univ.
Oxon. Socii.

OXONII,
E THEATRO SHELDONIANO.
AN. DOM. M. DC. LXXIV.

Isis, XV, pl. 2

T. S. PATTERSON

Title page and frontispiece cf Mayow's *Tractatus quinque* of 1674. From the Hunterian Library of the University of Glasgow. In the original the line below the words *De rhachitide* is 83.7 mm. long.

After the preface there comes an *Abstract* of the contents of MAYOW's *Tractatus Quinque* (1674), pp. 1-18, followed by an *Analysis* of MAYOW's *Chemical Opinions*, which is paged separately, 1-63.

§ 7. BEDDOES claim—no small one—for MAYOW is as follows : « He has clearly presented the notion of phlogiston, which rendered the name of STAHL so celebrated. He perceived the action of dephlogisticated air in almost all the wide extent of its influence; he was acquainted with the composition of the atmosphere, and contrived to make the mixture of nitrous and atmospherical air. He was well aware of the cause of the increase of weight in metallic calces, and distinctly asserted that certain bases are rendered acid by the accession of nitro-atmospherical particles, or what has since been denominated the acidifying principle. He discovered the method of producing factitious gas, and observed its permanent elasticity; and what is still more strange, he invented the nice art of transferring it from vessel to vessel. The doctrine of respiration is all his own. He has carried on his investigation of this function from the diminution of the air by the breathing of animals (as well as the burning of bodies) to the change it produces in the blood during its passage through the lungs and the use of the placenta. » (Preface pp. XXI, XXII), BEDDOES therefore takes a different view from FORSTER of MAYOW's services, even crediting him with the discovery both of the phlogiston and the antiphlogiston theories, previous to the enunciation of either.

§ 8. But if BEDDOES speaks with such high appreciation of MAYOW's achievements, he is nevertheless not quite blind to certain points which later writers ignore altogether, and although he thinks that we have, in MAYOW, one « who silently and unperceived in the obscurity of the last century, discovered, if not the whole sum and substance, yet certainly many of those splendid truths which adorn the writings of PRIESTLEY, SCHEELE, LAVOISIER, CRAWFORD, GOODWYN, and other philosophers of this day » (Preface, p. XXI), he still thinks that merit ought not be claimed upon « a loose expression, which he who used it, in all likelihood, threw out at random, and which impressed no idea upon the understanding of his contemporaries » (Preface, p. XII); and he says that, « if deficient proof be accompanied

by ambiguity of expression, may we not lay it down as highly probable that the passage bears some other meaning than that which coincides with the modern opinion ? » (Preface, pp. XIII-XIV). One may doubt, however, whether he made, himself, any very serious attempt to ascertain how far MAYOW's views really coincided with those of PRIESTLEY, SCHEELE, and LAVOISIER; BEDDOES' estimate of MAYOW's achievements, quoted in § 7, is inaccurate, not to say untrue, in almost every particular. He finishes by describing MAYOW's opinions as « a mingled mass of brilliant discoveries and hypotheses now repulsive and disgusting » (Analysis, pp. 61, 62); but BEDDOES did not make it by any means clear that these brilliant discoveries were really due to MAYOW or are to be found in his writings.

§ 9. Then, in 1793, came J. B. A. SCHERER's book (already referred to, § 4, note); and, in 1798, G. D. YEATS published *Observations on the Claims of the Moderns, to some Discoveries in Chemistry and Physiology, London*, 1798, in which he gave a translation of, and commentary on, a portion of MAYOW's work. This book, an astonishing piece of special pleading, in which all sense of proportion, criticism, moderation and even comprehension seems to have been lost, is mainly responsible for most of the later exaggerations regarding MAYOW.

§ 10. Some of the work of ROBERT BOYLE « demonstrated, » says YEATS, « that air was absolutely necessary to animal life and combustion; but in what way it answered these great purposes, continued as great a mystery as before. It remained, too, to be shewn, that only one part of the air entered the blood, during respiration, and was consumed by combustion. (6) Here it was that MAYOW, who was cotemporary with BOYLE, but when BOYLE was far advanced in years (7), commenced our knowledge of pneumatic chemistry. His invention of a pneumatic apparatus, the happy manner in which he executed his experiments, and his application of his discovery of vital air, to explain the wide influence of its effects in respiration and combustion, must give

(6) MAYOW had no idea that part of the air was *consumed* by combustion. (See § 122).

(7) A careless, rhetorical exaggeration; BOYLE, who was 17 years older than MAYOW, was only 42 when MAYOW's first book was published, and 53 when MAYOW died.

us a high idea of his genius. The works of this ingenious physician, certainly contain a great part of those noble truths, which have given reputation to the names of PRIESTLEY, SCHEELE, LAVOISIER, and others. » (pp. XXIX, XXX). It will be shown in the sequel (§§ 26, 82, 96) that, accidentally or otherwise, YEATS and others not merely distorted the sense of MAYOW's text, but confused the issues in question in various ways, whilst some of YEATS translations from MAYOW's latin are very misleading.

§ 11. It is doubtful if the championship by BEDDOES, SCHERER and YEATS did much to establish the reputation of MAYOW at the beginning of last century; at any rate, THOMAS THOMSON, writing in 1812, summed the matter up crisply as follows.

« MAYOW, in his Essays, published at Oxford about ten years after the Micrographia, embraced the hypothesis of Dr. HOOKE, without acknowledgment (8); but clogged it with so many absurd additions of his own, as greatly to obscure its lustre and diminish its beauty. » THOMSON adds a few words of approbation regarding MAYOW's views on respiration, air, combustion and affinity, remarks which suggest that he also had not studied MAYOW very carefully. (*History of the Royal Society*, 1812, p. 467).

§ 12. The difficulty of appreciating the thought of a previous age becomes greater and greater as that age is more remote, and therefore, after the lapse of another century, we find opinion tending still further towards the attitude of Yeats. Thus, G. F. RODWELL in a little book entitled *The Birth of Chemistry*, 1874 says, « MAYOW's work is remarkable in several respects. In it he conclusively proved that respiration and combustion are analogous processes; he upset the four element theory by demonstrating the compound nature of air; and he recognised oxygen and nitrogen as clearly and almost as notably as they were recognised a hundred years later—the one the supporter of life and combustion, the principle of acidity, and the cause of fermentation and putrefaction, heavier than atmospheric air; the other incapable of supporting life or combustion, and lighter than atmospheric air. ... The treatise is characterised by much clear and condensed thought, well sustained argument, and

(8) HARTOG, *Dict. Nat. Biog.* (1894, XXXVII, 175a) refers to this as a « bitter charge of plagiarism, » but there is no reason to suppose, either that MAYOW intended or that HOOKE felt any plagiarism.

accurate reasoning; moreover, we seldom meet with instances of too hasty generalisation, always the dominant source of error in the early development of a science. (pp. 122, 123)

§ 13. Sir WILLIAM RAMSAY in his book, *The Gases of the Atmosphere*, 1896, p. 17, says that MAYOW's « scientific work proves that if he had been granted the usual span of life, his extraordinary genius would have forwarded the knowledge of the true explanation of the nature of air, and its function in supporting combustion and respiration, and that his views would have been accepted more than a century before LAVOISIER—with fuller knowledge, and with the scientific position which at once gained a hearing—forced precisely similar doctrines upon the attention of the scientific world.» (9) He goes on to say that one of MAYOW's contributions to the chemistry of the atmosphere was that « the atmosphere consists of particles of two kinds of gases at least : one of these, termed « nitro—aerial particles », is necessary for the support of life and for the combustion of inflammable bodies; while the other, left after this constituent has been removed, is incapable of supporting either life or combustion. » (p. 19) « All this, » he says, « is exceedingly clear, and in accordance with our modern views » (p. 24);—and indeed, as RAMSAY puts it, so it is.

He proceeds : « the tale would be incomplete without mention of the fact that he prepared a gas by the action of nitric acid on iron, viz., nitric oxide, which, when introduced into ordinary air confined over water, decreased its volume; and he found that further admission of nitric oxide produced no further diminution in the volume of the air. A very little more, and he would have recognised in this a means of analysing air, and depriving it wholly of its oxygen. » (loc. cit., p. 25).

§ 14. In his article in the *Dictionary of National Biography*, 1894, XXXVII, pp. 175—177, P. J. HARTOG gives a slightly more moderate account, remarking « It is too much to say, as some have done, that MAYOW proves his case fully », but this very moderation is almost more misleading than some of the exaggera-

(9) One of the most remarkable things about LAVOISIER's views was exactly the difficulty which he experienced in persuading his colleagues to accept them. As regards the precise similarity of MAYOW's and LAVOISIER's doctrines, see §§ 122-128.

tions. HARTOG says « In the tract on 'Respiration' (1668)... the function of breathing is merely, he says, to bring air in contact with the blood, to which it gives up its nitroaerian constituent (oxygen), and from which it carries off the vapours produced by the heating of the blood. He says that the heart... is a muscle, whose function is to drive the blood through the lungs and over the body, a view proved experimentally in the following year by LOWER (*De Corde*, 1669). MAYOW stands immeasurably above such men as WILLIS and SYLVIUS, with their medley of half-digested Cartesianism and Iatro Chemistry. He must be classed with HOOKE and BOYLE, possessing the scientific imagination of the one, the tenacity of the other, and succeeding where BOYLE failed. »

§ 15. Even CRUM BROWN and DOBBIN, who had certainly devoted much attention to MAYOW, in the preface to their translation of the *Tractatus quinque*, also make remarks liable to misconstruction. They say that « those who discovered it [the *Tractatus*] were astonished to see that the new chemistry, which was rapidly conquering the scientific world, was to be found in this old book. » (Pref., p. IV). It is the object of the present paper to show that MAYOW's views, critically examined, bore no resemblance to the new chemistry, and that MAYOW's commentators merely *thought* that the new chemistry was to be found there, which is quite a different thing. CRUM BROWN and DOBBIN also say « that most of BOYLE's treatises appeared shortly after » MAYOW wrote (Pref., VI). Although this is true as a statement of fact, it conveys rather a wrong impression. Up till the time at which MAYOW's *Tractatus quinque* appeared (1674), BOYLE had published no less than thirteen treatises of the first importance, and it was exactly from some of these that MAYOW drew most of his inspiration.

§ 16. Some years later, in a lecture entitled « *Two Oxford Physiologists* RICHARD LOWER 1631—1691 JOHN MAYOW 1643—1679. » *Oxford. Clarendon Press* 1908, FRANCIS GOTCH, Waynflete Professor of Physiology at Oxford, after a tolerable account of LOWER, has given perhaps as erroneous a description of MAYOW's views, as is humanly possible. « JOHN MAYOW, » he says, « was one of the greatest scientific men of the seventeenth, or indeed of any century. » (p. 5). « In 1668, in the twenty-fifth year of

his age, he published his first work, the *Tractatus de Respiratione*, in which he showed that there was a special vapour or gas in the air necessary for both combustion and life; thus, more than a hundred years before PRIESTLEY and LAVOISIER, he had discovered Oxygen. » (p. 9). MAYOW found that « the air lost weight by giving up this constituent which was essential both for the production of flame and for the sustenance of life. He proved this by a number of convincing and beautiful experiments. » « MAYOW's discovery was far more than the disclosure of a fact, it carried with it a whole world of new conceptions, for the importance of this air constituent, both to inanimate and to animate things, was revealed to his mental vision. » (p. 25). These conceptions « stamp MAYOW as one of the greatest of scientific men. » MAYOW considered flame to be « the chemical union of such nitro-aerial particles with the more volatile salino-sulphureous ones » (p. 26). « MAYOW's account of the formation of acids and of oxides is in all essentials that elaborated a century later by LAVOISIER » (p. 27), etc., etc.

§ 17. But GOTCH—not unnaturally in view of his surprising notion of MAYOW's achievements—was puzzled by a very striking fact—one the significance of which he entirely failed to understand. « The astonishment which is produced in our minds by MAYOW's extraordinary scientific achievements is only equalled by the undoubted fact that in spite of what appears to us to be the lucidity of this presentation, his work caused no conviction in the minds of his contemporaries and was disregarded for more than a century » (p. 32). GOTCH then proceeds « to throw a side-light upon the matter » (p. 35), and propounds the theory that the neglect of MAYOW was due to the fact that the reviews of MAYOW's work which appeared in the *Philosophical Transactions of the Royal Society* « set forth his conceptions in such a crude way and in language so imbued with the traditional errors of the age, that they could not fail to produce an unfavourable impression upon the more acute intellects » (p. 37). This will be referred to further on (see §§ 58-65), and an attempt will be made (§§ 82—96; 125, 126, 128, 129), to throw a rather more convincing light upon the subject.

§ 18. Later still R. T. GUNTHER, *Early Science in Oxford, Pt. I—Chemistry*, 1921, apparently influenced by GOTCH, says that

MAYOW, the « greatest chemist whom Oxford has ever produced », « showed that air was a mixture of two kinds of gases, the one spiritus nitro-aereus, necessary both for combustion and respiration, and the other incapable of supporting combustion and respiration, which was left after the removal of the spiritus » and this, according to GUNTHER, was « the practical discoveryof oxygen. » (p. 32).

« In short, MAYOW had grasped the essential facts about the formation of acids and oxides (see on §§ 124—128), and had thus anticipated the work of LAVOISIER (1775) by more than a century... His works, a century in advance of the times, were unappreciated during his life and were soon neglected, buried and forgotten under a thick pall woven in Germany by STAHL, out of a warp of genuine facts and a weft of false hypotheses.

« The false hypothesis was the assumption of phlogiston; the resultant fabric was so cunningly woven that a generation of chemists (including such men as CAVENDISH and BLACK, PRIESTLEY, SCHEELE and BERGMAN) failed to notice the many glaring contradictions in its meshes between the actual facts and the phlogistic doctrine. Had they been able to emancipate their mental vision from the speciously simple explanation of STAHL, and had studied the *Tractatus* of MAYOW with an open mind, (10) the chemistry of the eighteenth century would have proceeded on a higher plane. (see on § 156).

« But then, it must also be remembered that the first accounts that appeared of MAYOW's work were abstracts printed in the *Philosophical Transactions* which grossly misrepresented his views and mis-stated his discoveries. » (p. 33; see on §§ 58—63, 83—86).

§ 19. SINGER, *A Short History of Medicine*, 1928, repeats these views and refers to MAYOW's forgotten « discovery of Oxygen in the seventeenth century, which was repeated by PRIESTLEY a hundred years later » (loc. cit. p. 189; see on § 149) and says that « The great theorists, STAHL, BOERHAAVE and HALLER, knew him not, (11) and STAHL's doctrine of *phlogiston* set back the

(10) The present paper is intended to show that if the modern commentators had read MAYOW's *Tractatus quinque* with an open mind, instead of quoting and amplifying the quite unjustified eulogies of BEDDOES and YEATS, MAYOW, long ago, would quietly have dropped back into the oblivion from which there was never any real necessity to recall him.

(11) MAYOW's work was not entirely forgotten. It is referred to by STEPHEN

hands of the clock. » (loc. cit. p. 151, also pp. 126, 188—189, see § 156).

§ 20. In a similar manner J. S. HALDANE in his recent Gifford Lectures, *The Sciences and Philosophy*, 1929, says « MAYOW then showed that it is only a certain constituent of air that is necessary in both cases [respiration and combustion], and connected this constituent with what is present in nitre and enables combustion to occur, as in gunpowder, without the presence of air. He called this constituent ‚nitro-aerial spirit,' and put forward the theory that nitro-aerial spirit is absorbed from the air by the blood passing through the lungs, and separated from it in the brain in some such manner as DESCARTES had suggested; also that muscular contraction is due to an explosive combination in the muscles of nitro-aerial spirit and combustible material, with evolution of heat, the nitro-aerial spirit being allowed to pass down nerve tubules and so reach the muscles. » (pp. 25, 26, see § 137).

§ 21. In view of these remarkable claims on behalf of MAYOW, and the manner in which they are gradually insinuating themselves into the literature of chemistry, it seems worth while to go into the matter rather more carefully than appears hitherto to have been done, in order to ascertain exactly what MAYOW's views (12) represented to himself, and, especially, how they were likely to strike his contemporaries; and to discover, if possible, a better reason than that given by GOTCH for the fact that, in spite of what is now claimed for them, they should have been so singularly unsuccessful in his own time. For it must be remembered carefully that some of MAYOW's colleagues were men of very unusual ability, and that if MAYOW's views did not impress them, there was, most probably, some good reason for the fact.

§ 22. To find such a reason is indeed easy : but clearly to set it forth, and adequately to expose the manner in which

HALES (e.g. *Vegetable Staticks*, 1727, Expt. CVI, p. 230; Expt. CVII, p. 232). As regards STAHL, it may be mentioned that Part III of his *Fundamenta Chymiae*, 1747, commences with a list, « Nomina scriptorum aliorumque in hoc libro allegatorum » in which MAYOW's name is quoted along with those of MARIA PROPHETISSA, DEMOCRITUS, PARACELSUS, etc. But, of course, this was after Stahl's death. The list does not occur in the 1723 edition.

(12) Or rather some of MAYOW's views, those that have been most extolled. It would be impossible—and highly unprofitable—to deal with them all.

MAYOW's views have been distorted into a resemblance to modern ideas is much more difficult. It is, however, the object of the following pages to show that practically every one of the statements quoted above concerning MAYOW's views is either quite definitely erroneous or at least so misleading as to convey an entirely false impression. There has been, in fact, an astonishing tendency, one might almost say, a conspiracy, amongst modern writers, (1) enormously to exaggerate the resemblance of MAYOW's views to our own; (2) to read into his statements ideas that were by no means in his mind; (3) to credit him with the discoveries and views of others; (4) to confuse the *Tractatus duo* with the *Tractatus quinque*; and (5) to depend upon what has been written about MAYOW, rather than upon what MAYOW wrote.

§ 22. In the first place it must be remembered that most of the work contemporary with MAYOW's has now faded into oblivion. It is as difficult to find it on library shelves as it is to find the original editions of MAYOW : very few students have any acquaintance with it whatever. In MAYOW's own time things were quite different. A very active scientific spirit was abroad, and MAYOW's colleagues were able to assess his work in direct comparison with that of the other workers of the time; they could distinguish much more definitely than we can which experiments and views were due to MAYOW's contemporaries and which were due to MAYOW himself—the latter by no means numerous. Their perspective was undistorted by time, and they were therefore much less liable than we are to give MAYOW credit for work to which he has no title. It was easy for them to discern that, in his writings, such views as were sound were not MAYOW's, whilst those which were MAYOW's were not sound. The modern reader is in a very different position; he can study MAYOW's book in a recent English edition, but has no easy access to the others, and, unless he is very careful, is extremely apt to claim for MAYOW vastly more than is due. And, indeed, MAYOW's commentators ever since BEDDOES' time have been most busily engaged in attributing to their hero, in an astonishingly uncritical fashion, a very great deal to which he has no right whatever.

§ 23. In the second place it is almost impossible for a modern reader to struggle conscientiously through the whole of MAYOW's

work, a fact sufficient in itself to show how little classic it is. But here and there the reader is struck by wording which seems to express quite modern ideas, and he unconsciously tends to credit MAYOW with these same ideas. Thus, for example, when the reader comes across the passages : « With regard then to the aerial part of nitrous spirit [nitric acid], we maintain that it is nothing else than the igneo-aerial particles which are quite necessary for the production of any flame » (M., p. 13), and, fire « cannot be kindled without nitro-aerial particles » (M., p. 17); he is very favourably impressed. It happens that they are merely statements in slightly different language of the views of HOOKE and others, but this the reader is apt to overlook; and he will probably also overlook the fact that by these statements MAYOW means something very different from what we mean by them (see on §§ 122—128). One of the most striking of these is, perhaps, MAYOW's remark that the chief use of « respiration of animals is to introduce nitro-aerial particles into the mass of the blood, and it does not matter how this is done. » (M., pp. 220, 221; see §§ 132, 133).

§ 24. Then immediately after some such passage the reader encounters others which he can only regard as sheer nonsense. For example, « And, indeed, I do not know anything in nature approaching nearer to fire than the red spirit of nitre [nitric acid] which passes into the receiver in the course of distillation, with a ruddy colour; but the ruddiness of nitrous spirit, rivalling flame, seems to be due to the igneo-aerial particles of the spirit, which are agitated with an almost fiery movement. » (M., p. 14). This is merely a series of gratuitous assertions, similar to some which had been expressed a few years previously by WILLIS (see § 39), which the modern reader feels at once to be absurd, and he is therefore apt to pass them over without careful reflection, and without considering to what extent they bear upon and modify MAYOW's apparently sounder notions. This is, perhaps, the main reason for the distorted view of MAYOW's services already referred to, and it is not at all easy, fully to appreciate how strong it is.

§ 25. In the third place, MAYOW's principal book is written in so confused a manner that it is particularly difficult to follow; and, especially, to summarise. He keeps constantly saying that

certain ideas will be established further on, without saying exactly where, or that something else has already been shown further back; and, in despair of finding the references, the reader is apt to accept the statements as true, whereas if he does happen to come across one, he discovers, instead of any kind of proof, merely another unsupported and frequently ridiculous assertion.

§ 26. Finally, BEDDOES and particularly YEATS have often entirely distorted the plain meaning of MAYOW's words; and later writers, evidently relying on these commentators, have not thought it worth while to examine MAYOW's own writings; whilst further difficulty has been introduced into the subject by the very careless confusion, by the commentators, of MAYOW's tract on respiration, of 1668, and the second edition of this tract, of 1674.

§ 27. For the reasons mentioned above, it seems desirable, before considering MAYOW's work, to discuss the advances which had been made by his contemporaries, on the subjects of respiration and combustion; but, in the first place, the names of some of these remarkable people may be recalled.

§ 28. On 3 April 1658, when he was almost 15 years of age, (13) JOHN MAYOW entered Oxford (Wadham College), and, if he was old enough to appreciate the fact, he found himself in distinguished company. THOMAS WILLIS (1621—1675) had entered at Christ Church in 1636; (14) and from 1660 was Sedleian professor of natural philosophy, but set up a practice in London in 1666. (15) ROBERT BOYLE (1626—1691) had settled in Oxford in 1654, and carried out there some of the work which made him perhaps the greatest figure in the scientific world of his time, and still entitles him to one of the very highest positions. CHRISTOPHER WREN (1632—1727) was elected to a fellowship of All Souls in 1653 and held it until 1661. From 1657—1661 he was professor of astronomy at Gresham College, and was Savilian Professor at Oxford from 1661 until 1673. RICHARD

(13) There seems to be some doubt about MAYOW's age. ANTHONY WOOD (*Athenae Oxonienses*, 2nd Edn., 1721, *II*, 637) by implication, makes him out to have been born in 1645. HARTOG (*D. N. B.*, 1894, XXXVII, 175a) says 1643, whilst GUNTHER (*Early Science in Oxford*), adopts 1643 in some places (*I*, 31, *III*, 542, 543), and 1640 in others (*III*, 136, 137).

(14) MUNK, *Roll of the Roy. Coll. Phys. of Lond.*, 1861, *I*, 322.

(15) WOOD, *Athenae Oxonienses*, 2nd Edn., 1721, *II*, 549.

LOWER (1631—17 Jan. 169$^{0}/_{1}$), student of Christ Church in 1649, early became associated with WILLIS, and had his attention directed to the difference between venous and arterial blood, in connection with the phenomenon of respiration, which was then exciting much interest. An entry in JOHN WARD's diary in 1658 mentions that « Dr. WILLIS and DICK LOWER opened a dogg and they first let him blood in the jugulars to discover whether arterial and venal blood did differ in colour and constitution. » (*Trans. Med. Soc. London*, 1917, 40, 15). ROBERT HOOKE (1635—1703) also entered Christ Church about 1650, was assistant to WILLIS for a time and then became assistant to BOYLE, but in 1662 was appointed curator of experiments to the Royal Society, and was nominated for M. A., in 1663 (A. WOOD, *Athenae Oxonienses*, 2nd Edn., 1721, *II*, 1039).

§ 29. These MAYOW knew, at least by hearsay, but quite possibly in person, at Oxford. His scientific education was derived very largely from their investigations. He became interested in the questions they were trying to resolve. Exactly what his course of study was we do not know but he had become a scholar of All Souls 23rd September 1659, and, on the recommendation of HENRY COVENTRY (later Secretary of State) he was elected to a Fellowship of All Souls on 3 November 1660, at the age of 17. (16)

§ 30. In 1660 ROBERT BOYLE published his *New Experiments Physico-mechanical, touching the spring of the Air, and its Effects.* In this book he discussed several phenomena referred to, eight and fourteen years later, by MAYOW, and, since MAYOW is very often given credit for facts or views either established or previously mentioned by BOYLE, there are given, in the sequel, in addition to the reference to BOYLE, also the reference to the passage of MAYOW dealing with the same subject fourteen years later.

(16) This seems to show that MAYOW had considerable influence. LOWER was unable to obtain a Fellowship at Christ Church and was even put out of his studentship. In a letter to ROBERT BOYLE of date June 24, 1664, he says, « If you write to me again, you may not direct it to me a student of *Christ Church*, for I have been put out of my place above a year and half since, for not being in orders, without which I could not keep my student's place, unless I had got a physician's place in the college, there being two allowed, but I had not the favour or friendship to obtain either; but I live in a chamber of the college, where, if you are pleased to honour me with a letter at any time, I shall most gladly receive it. » (BOYLE's *Works*, 1744, V, 525a.).

§ 31. In his *New Experiments* BOYLE described the preparation of « air » by the action of dilute aqua fortis on iron (178, 91, *M.*, 111), (17) and also from dilute oil of vitriol and iron (176, 90, *M.*, 112); he also collected this « air » over water. These experiments, he thought, « seem'd manifestly enough to prove, though not that Air may be generated out of Water, yet that in general Air may be generated anew. » (179, 91, *M.*, Chap. IX). Further on he deals with the generation of « air » by the action of red coral on spirit of vinegar (384, 199). He also made an attempt to weigh the air (272, 141) and showed that animals died very quickly when deprived of air (328, 170). This led him to *A Digression containing some Doubts touching Respiration* (18) in which he discusses the views prevalent at the time (335, 174). He considers the cause of air entering the lungs (336, 176; *M.*, 183) and mentions the idea that respiration might be for cooling the blood (347, 181; *M.*, 202) and that it ventilates the blood in its passage through the lungs « in which passage, it is dis-burthened of those Excrementitious Steams, proceeding, for the most part, from the superfluous Serosities of the Blood, » the opinion apparently of MOEBIUS and GASSENDUS. (19) (350, 182; *M.*, 204).

(17) The first number refers to the page of the first (1660) edition, the second to the page of the second (1662) edition of BOYLE's book, and the third reference is to the page in Alembic Club Reprint, No. 17, where MAYOW later (1674) refers to the same subject.

(18) As an example of the subtle kind of misrepresentation which we meet with in connection with this subject a casual remark of GOTCH's may be quoted. He says, referring to this passage : « BOYLE, writing at the same time as LOWER and MAYOW, gives an instructive account of the prevalent confusion of thought on this subject » (*loc. cit.*, pp. 13, 14). Now, in fact, BOYLE wrote, not « at the same time as », but eight years previously to MAYOW and LOWER—and not only these two authors, but also many others, were deeply indebted to BOYLE for his *Digression*—their work, in many respects, being the direct outcome of his.

(19) HARVEY's view expressed in *Exercitationes duae anatomicae de circulatione sanguinis. Ad* JOHANNEM RIOLANUM *filium. Roterodami*, 1649, was « Unde quoque probabile foret, pulmonum expirationem esse, quâ his efflatis, eventaretus et depuretur sanguis. Atque inspirationem esse, ut sanguis pertranseundo inter ventriculos duos cordis, contempereter, ambientes frigore : ne excandescens, et intumescens quadamque fermentatione inflatus, (sicuti effervescens mel et lac) adeo distenderet pulmonem, ut suffocaretur animal. » (p. 75). (« Whence also it becomes probable that the expiration of the lungs is a means by which these vapours being cast off, the blood is fanned and purified; whilst inspiration is a means by which the blood in its passage between the two ventricles of the heart is tempered by the cold of the ambient atmosphere, lest, getting heated,

The idea that breathing or combustion ceases because the air becomes overcharged with exhalations seems to be disproved by the fact that when air is sucked out of a vessel, leaving, one would imagine, extra room for exhalations, combustion or respiration cease even more rapidly than otherwise.

§ 32. Although a bird in a closed glass vessel may live for a considerable time, it dies very quickly after exhaustion of the air (362, 187) and he thinks « that there is some use of the Air which we do not yet so well understand, that makes it so continually needful to the Life of Animals. PARACELSUS indeed tels us, *That as the Stomack concocts Meat, and makes part of it useful to the Body, rejecting the other part, so the Lungs consume part of the Air, and proscribe the rest.* (20) So that according to our Hermetick Philosopher... we may suppose that there is in the Air a little vital Quintessence... which serves to the refreshment and restauration of our vital Spirits, for which use the grosser and incomparably greater part of the Air being unserviceable, it need not seem strange that an Animal stands in need of almost incessantly drawing in fresh Air. But though this

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and blown up with a kind of fermentation, like milk or honey set over the fire, it should so distend the lungs that the animal got suffocated. » ROBERT WILLIS's translation, 1847, p. 119).

(20) BOYLE does not give a reference to this, but presumably he had in mind the following passage : « Et veluti ventriculus cibum suum digerit, partim in corporis nutrimentum illum vertens, partim reliquias ex corpore exturbans ; sic idem etiam de aëre iudicandum est, cuius pars vna digeritur ac consumitur, altera excernitur specie excrementi. Aëris enim et cibi eadem ratio, idem iudicium est. » (PARACELSUS, *De Morbis Metallicis sev mineralibvs, et aliis his Cognatis. Opera*, 1658, *I*, 707b). (« And just as the stomach digests its food, partly converting it to the nourishment of the body, partly throwing out the residue from the body : so the same judgment may be made regarding the air, one part of which is digested and consumed, the other is separated as a kind of excrement. The same reasoning and the same judgment must be applied to food and air. »)

K. F. H. MARX, (*Abhandlungen der Königlichen Gesellschaft der Wissenschaften zu Göttingen*, 1843, *I*, p. 168) mentions a number of other passages by PARACELSUS to the same effect, for example, (p. 168, note 430) « Nun so wissend am aller ersten, dass das blut, marck und fleisch auch an sich zeucht seine narung, und in ihm selbst dawet, und scheidet von ihm das nit sein ist » (*Paramir.* L. III. *De orig. morb. ex Tart.* Tr. 5. Th. 1. 176); and gives the substance of PARAMIR. L. III, Tr. 4, Th. I. 167, as follows, « Die Adern in den Lungen seyen der Magen der Lungen; in ihnen reinigten sie das Reine vom Unreinen. Das ihnen zustehe, behielten sie; das andere würfen sie durch ihre Röhren zum Munde hinaus. » (pp. 168, 169). In this connection another opinion of PARACELSUS may be recalled : « Aer simplex non est. » (*Opera*, 1658, II, p. 365b).

Opinion is not... absur'd... it should not be barely asserted, but explicated and prov'd. » (363; 188) This passage shows that the idea of something being taken from the air « a little vital quintessence » originated long before HOOKE or MAYOW; perhaps indeed it is a better approximation to the modern idea than anything expressed by MAYOW. It also illustrates BOYLE's attitude in regard to such views, they « should not be barely asserted, but explicated and proved. »

§ 33. Again, the flame of a lamp is extinguished by removal of air just as is the life of an animal (366; 190; *M.*, 68) and he points out that the gills of fishes « seem somewhat Analogous (as to their use) to the Lungs, » and that fishes die in ponds that are frozen over (370; 192; *M.*, 179). Air, he says, lurks in water, and of it « Fishes may make some use, either by separating it, when they strain the water thorow their Gills, or by some other way. » (371; 193; *M.*, 179). He pointed out that an eel in an exhausted receiver turned on its back, but revived on admission of air (371; 193; *M.*, 179). He also discusses respiration in the embryo. (372; 194; *M.*, 211-227).

§ 34. In 1661, BOYLE's *Physiological Essays* were published, containing (107-135; 129-158) (21) (1) *An Experiment with some Considerations touching the differing Parts and Redintegration of Salt-Petre*, in which he decomposed hot nitre by means of charcoal to give fixed nitre, and from the fixed nitre by means of spirit of nitre reproduced the salt-petre (109; 134; *M.*, 2, 3), which last he considered to be produced by the union of the volatile and the fixed part (110; 135; *M.*, see on § 102) and thought, from the heat produced by the action of salt of tartar or potash and aqua fortis, that heat might be « nothing but a various and nimble motion of the minute particles of Bodies. » (115; 137; *M.*, 30, 45, 220). He also refers to the fact that glowing charcoal immediately catches fire when put into molten salt-petre, whereas nitre heated alone in a crucible merely melts (121; 143; *M.*, 19) and notes that when salt-petre is distilled, « the volatile liquor and fix'd Salt into which it is reduc'd by the fire, are endowed with properties exceeding different both from each other, and from those of the undissipated Concrete, » the former being

(21) The former reference in each case is to the first edition, the latter to the second (1669).

acid and the latter alkalizate (124; 147; *M.*, 2). He deals also with the decomposition and synthesis of salt-petre (128, 129; 150, 151; *M.*, 2). In the same year BOYLE published his *Sceptical Chymist;* in 1662 the second edition of his *New Experiments;* in 1663 *Considerations touching the Usefulness of Experimental Natural Philosophy;* in 1664 (or 1663) *Experiments and Considerations touching Colours;* and in 1665 *New Experiments and Observations touching Cold.*

§ 35. ROBERT HOOKE, who had assisted BOYLE with his air pump, was also, naturally, interested in such matters; and, as curator of experiments to the Royal Society, he made on Jan. 28, 166 $^{2}/_{3}$ an « experiment of shutting up in an oblong glass a burning lamp and a chick; and the lamp went out within two minutes, the chick remaining alive, and lively enough. » (BIRCH, *loc. cit.*, 1 180; *M.*, p. 75). On July 30, 1663 WREN suggested some experiments suitable for the entertainment of the King on his projected visit to the Royal Society, and says, « It would be no unpleasing spectacle, to see a man live without new air as long as you please. A description for cooling and percolating the air that once I formerly shewed the Society and left with Mr. BOYLE : I suppose it worth putting in practice. You will at least learn thus much from it, that something else in air is requisite for life, than that it should be cool only, and free from the fuliginous vapours and moisture it was invested with in expiration; for all this will, in probability, be separated in the circulation of the breath in the engine. If nitrous fumes be found requisite (as I suspect) ways may perhaps be found to supply that too, by placing some benign chemical spirits, that by fuming may impregnate the air within the vessel. » (BIRCH, *loc. cit.*, 1, 290). On the 30th March 1664 HOOKE described how a little bird which he had placed in a receiver containing air compressed to a quarter had lived from 11 a. m. till 10 p. m. (BIRCH, *loc. cit.*, I, 404). On May 25, 1664 the effect of compressed air upon a mouse was tried (BIRCH, *loc. cit.*, I, 428). On the 18th January 166 $^{4}/_{5}$ the Royal Society had been discussing the question of combustion and HOOKE suggested that since air much rarified « was found to make burning bodies go out, so condensed air would keep them longer alive » (BIRCH, *loc. cit.*, II, 8), and at the following meeting on January 25, it was found that a lamp, which would

only burn for some three minutes in a receiver containing air at ordinary pressure, could be made to burn for fifteen minutes when the air was compressed (BIRCH, *loc. cit.*, II, 10). On the 15th March 166 $^{4}/_{5}$ an experiment was made (apparently by HOOKE) by which a bladder from which the air had been pressed out was blown up « very plump » with air which had been generated by oyster shells and aqua fortis; BOYLE at the same time suggesting oyster shells and vinegar as suitable substances for producing an air which might be useful for respiration, and (on the suggestion of WREN, see BIRCH, *Mar.*, 8, 166 $^{4}/_{5}$, II, p. 20) an ox bladder had been blown up by fixing it to the mouth of a vessel containing a fermenting liquor when « the bladder was almost half filled with an aerial spirit, generated by the working liquor. » (BIRCH, *loc. cit.*, II, 22; see also *Phil. Trans.*, November 22, 1675, No. 119, X, 445, note). It appears therefore that by April 1665 considerable progress had been made on the experimental side of gas technique, combustion and respiration.

§ 36. On January 4, 166 $^{4}/_{5}$ « Mr. HOOKE made an experiment tending to shew, as he conceived, that air is the universal dissolvent of all sulphureous bodies, and that this dissolution is fire; adding, that this was done by a nitrous substance inherent and mixt with the air. » (BIRCH, *loc. cit.*, II, 2); and he showed at the same time that a combustible substance kept at a temperature sufficient to melt copper would not waste, *(ibid)* which, in fact, had already been shown by VAN HELMONT (*Oratrike* 1662, p. 106, § 13.). Similar experiments were made at the meetings on January 11 (BIRCH, II, 4) and 18 (BIRCH, *loc. cit.*, II, 8) when Sir ROBERT MORAY suggested that compression of the air might cause extinction of fire. HOOKE, however, « was of opinion, that as air much rarefied, wherein the parts are enlarged, was found to make burning bodies go out, so condensed air would keep them longer alive », and BOYLE suggested that after fire had become extinct, an attempt might be made to rekindle it by means of a burning glass or otherwise. (BIRCH, *loc. cit.*, II, 9). On January 25, 166 $^{4}/_{5}$ it was found that a lamp would burn longer in compressed air than in uncompressed air and « Dr. ENT suggested, that some animal and a burning candle might be included together in a close glass-vessel, to see, whether they would live one as long as the other. » (BIRCH, *loc. cit.*, II, 10). On February 15, 166 $^{4}/_{5}$ « Mr. BOYLE affirmed,

that gun-powder burns very well in a receiver, out of which the air has been extracted » (BIRCH, *loc. cit.*, II, 15, see also § 74), and on the same day « Mr. HOOKE made an experiment of gun-powder burning without air. » *(ibid.)* On March 1, 166$^{4}/_{5}$ sulphur dropped upon nitre in a red-hot iron crucible in an exhausted receiver flamed « as freely, as if it had been in the open air. » (BIRCH, *loc. cit.*, II, 19). On the 8th March, 166 $^{4}/_{5}$ BOYLE's experiment of casting filings of tin upon nitre over a fire, made it flame « though it was not known, that any sulphur ever was extracted out of tin; which seemed to infer that there are bodies combustible, that are not sulphureous » (BIRCH, *loc. cit.*, II, 20).

§ 37. GUNTHER (*loc. cit.*, I, 33) says « No chemist before MAYOW appears to have collected gases in flasks or vessels inverted over water. » In this connection it may be mentioned that at the Royal Society on March 29, 1665, « An experiment was made for the generating of air by putting aqua fortis and the powder of oister-shells into a small glass-phial under water, and whelming a large glass filled with water over it, to receive the steam to be generated by the corrosion. The success of which was, that the whelmed glass was filled about a quarter full with an aerial substance. » (BIRCH, *loc. cit.*, II, 27). ***This was three years before*** MAYOW's ***first publication.***

§ 38. In 1659 THOMAS WILLIS had published at the Hague a volume entitled *Diatribæ duæ Medico-Philosophicæ : Quarum prior agit DE FERMENTATIONE sive De motu intestino particularum in quovis corpore ; altera DE FEBRIBUS, sive De motu earundem in sanguine Animalium. His accessit Dissertatio Epistolica DE URINIS.* A second edition appeared in 1660 and a third, at London, (22) in 1662. There was also an edition from Amsterdam in 1663, of which GUNTHER (*loc. cit.*, III, 61) reproduces the frontispiece. It is similar to that of the 1662 edition, but turned right for left.

§ 39. Two or three subjects are referred to in this book which have a connection with MAYOW later on. WILLIS says that on distilling nitre « the vapor sent forth is very red; so that the Receptacle shines with a splendor, as if a flame were shut up

(22) The first two seem to be very rare and seldom appear in library catalogues ; the third is commoner.

within it. » (23) (1662, Ch. X, p. 74 : Eng. Ed., 1684, p. 40, see back § 24 and on § 105), and on the following page (in both these editions) he states that nitre contains much sulphur. WILLIS also refers to an idea, held at that time, that cold and cooling were due to certain nitrous particles, apparently because solution of nitre in water was attended by the production of cold. « For Salt of every kind, being put to Snow or Ice, loosens their mixtures, and sends away the Nitrous and Congelative Particles from the Subjects; which presently being immersed in the neighbouring water, Congeal it, as if they were freshly blown from the North. » (24). Later on MAYOW (*M.*, p. 10), quite correctly, disputed WILLIS's statement about the sulphur in nitre, a fact which shows that he had read the book, and was therefore likely to have been influenced by the various notions, common at that time, about nitrous particles.

§ 40. To one of the editions (25) of this book EDMUND MEARA published, at London, a rejoinder, dedicated to KENELM DIGBY, with the title, ***Examen Diatribæ Thomae Willisii de Febribus. Cui in accesserunt Historiæ aliquot medicæ rariores.*** The title page bears the date 1665 but the imprimatur is dated Oct. 27, 1664.

§ 41. To this RICHARD LOWER, WILLIS's assistant, published a reply, dedicated to ROBERT BOYLE, entitled ***Diatribæ Thomæ Willisii, De Febribus Vindicatio adversus Edmundum de Meara.*** The title page bears the date 1665 and the imprimatur is dated March 22, 1664 (26) (i. e. March 22, 1665, N. S.). In this book LOWER discusses the inkindling (accension) of the blood—which was attributed to a fermentation in the heart—and the resemblance of the life process to fire. He had found (erroneously, see on § 68) that the blood in the pulmonary vein and the pulmonary artery were both black, which, he thought, was due to the fact that blood in the pulmonary artery had not yet passed through

(23) It is perhaps worthy of mention that HOOKE, *Micrographia*, 1665, thinks that nitrous vapours would be red « as is made evident by looking at bodies through the fumes of Aqua Fortis or spirit of Nitre » (p. 229) as « the most illustrious and incomparable Mr. BOYLE » (p. 227) had demonstrated.

(24) 1662, p. 95 : Eng. Ed., 1684, pp. 51, 52 : See *M.*, p. 93 « And this seems to be the reason that the north wind is very dry and cold, since it brings with it air which is heavy with nitro-aerial particles and these extremely cold and dry. »

(25) Not that of 1662 since the references do not agree.

(26) There is a notice of the book in *Phil. Trans.*, 1665, Vol. I, No. 4, p. 75.

both ventricles of the heart, and was therefore still very imperfectly mixed and kindled. (27)

§ 42. In continuation of his investigation, LOWER, in a letter to ROBERT BOYLE of 24 June 1664 (already referred to, § 31, note), says he proposes to investigate « the reason of the different colour of the blood of the veins and arteries : the one being florid and purple red, the other dark and blackish » (pp. 523, 524). The blood from an artery in a dog's thigh was constantly florid, whilst that from a vein remained black except for a thin skin on the surface. Also in letting blood it is found that the last part, coming from the arteries is always the most purpureous.

§ 43. It is thus quite clear that LOWER attacked this problem in an experimental and eminently scientific spirit, and that he was busily engaged upon it during the next two years, doubtless teaching to his pupils at Oxford—of whom, then or later, MAYOW was probably one—the facts that he was discovering. He also, on one and the same day, June 28, 1665, took both the degree of Bachelor and Doctor of Physic by accumulation (WOOD, *Fasti*, 2nd Ed., 1721, II, Cols. 160, 161), and became, according to GUNTHER (*loc. cit.*, I, 31), chief assistant to WILLIS with whom, however, he had already been working for some years. Just before, on May 30, 1665, JOHN MAYOW of All Souls College had taken the degree of Bachelor of Law (WOOD, *ibid.*, 160). Thus, while LOWER was investigating the cause of the difference between venous and arterial blood, MAYOW, 22 years old, was graduating in law.

§ 44. ROBERT HOOKE, who in 1665 had become Professor of Geometry at Gresham College, published in that year his very remarkable *Micrographia*, which, although it professed merely to give some « physiological descriptions of minute bodies », contained also very important views not only upon combustion, and the nature of air, but also the nature of light. « Fire » he thought « is nothing else but... a dissolution of the burning body, made by the most universal menstruum of all sulphureous bodies, namely the Air. » (p. 55). The air is the universal solvent of sulphureous bodies, performing this action

(27) Sed in promptu est referre sanguinem in pulmonibus utrumque venoso similem videri, quia nondum in utroque cordis ventriculo accensus, imperfectius adhuc misceatur ac inflammetur. (p. 118).

only when the body is sufficiently heated; the action of dissolution produces the great heat which we call fire, giving rise also to the pulse of light. This dissolution of sulphureous bodies « is made by a substance inherent, and mixt with the Air, that is like, if not the very same, with that which is fixt in Salt-peter » (p. 103). And since the dissolvent parts of the air are but few, fresh air is to be constantly and repeatedly added to the body being dissolved, or else the fire will be extinguished. Salt-petre, however, abounds with these dissolvent particles and therefore a small quantity of it dissolves a crude sulphureous body, the dissolution being quick and violent. Similarly a constant supply of air by bellows assists combustion vigorously. Finally, flame « seems to be a mixture of air, and the combustible volatile parts of any body, which parts the encompassing Air does dissolve or work upon. » (p. 104). He hopes elsewhere « to shew the use of the air in respiration. » (28) In the same year was published BOYLE's *Hydrostatical Paradoxes* and also his *Origine of Forms and Qualities*.

§ 45. Meantime, LOWER was engaged upon work which ultimately led to the important discovery of the transfusion of blood. CHRISTOPHER WREN, about the year 1659, was, apparently, the first to attempt injections into the blood of animals, an account of his work being given by ROBERT BOYLE (29) who himself, at Tunbridge, had apparently syringed water into the vein of a dog, LOWER, shortly afterwards, having done the same, as he mentions in a letter to BOYLE of Jan. 18, 166 $^1/_2$ (BOYLE's *Works*, 1744, V, 518a), as also his intention of trying other liquids by way of food. He performed his first successful experiment on transfusion, at Oxford about the end of February 166 $^4/_5$. (30)

§ 46. In 1666 LOWER left Oxford for London (31) (WOOD,

(28) He never seems to have redeemed this promise.

(29) *Some considerations touching the usefulness of experimental Natural Philosophy*, 1663, Pt. II, pp. 52-55; see also *Phil. Trans.*, Dec. 4, 1665, I, No. 7, p. 128; and for TIMOTHY CLARK's experiments BIRCH, *loc. cit.*, I, 281, 303, and *Phil. Trans.*, Monday May 18, 1668, III, No. 35, p. 672.

(30) *Life and Times of Anthony Wood* : CLARK, 1891, II, 30 : PEPY's *Diary*, 14th and 16th Nov. 1666; 21st Nov. 1667. The subject was referred to at the Royal Society, April 18, 1666, and June 13, 1666 (BIRCH, *loc. cit.*, II, 83, 84, 98).

(31) Presumably later than 19 March 166 $^5/_6$, the last date in that year on which WOOD records a meeting with him. LOWER was back in Oxford in Feb. 166 $^6/_7$, consorting with WOOD in various taverns. (CLARK's *Life and Times of Wood*, 1891, II, 73, 99).

Athenæ Oxoniensis, 2nd Edn., 1721, II, 857), where he continued his scientific work, being present frequently at meetings of the Royal Society (BIRCH, *loc. cit.*, II, 242, 243, 255 et passim), and in a letter to ROBERT BOYLE of September 3, 1666, dated from Treemere, near Bodmin, Cornwall (BOYLE's *Works*, 1744, V, 528b), he describes his process for carrying out the transfusion operation. (32) This was published a little later in the *Philosophical Transactions of the Royal Society* (Munday, December 17, 1666, Vol. I, No. 20, p. 353; see also ibid, No. 22, p. 385; and BIRCH, *loc. cit.*, II, 115, 123, 125, 132, 133, 225, 227). These investigations made him, deservedly, a famous man. (33)

§ 47. In 1667 WALTER NEEDHAM in his *Disquisitio Anatomica de Formato Fœtu, Londini* 1667, (34) dedicated to ROBERT BOYLE, published his views on respiration, which are interesting as exemplifying the various notions held at the time. He rejected the idea of a vital flame, and thought that the accension (fermentation, inkindling) was made neither in the lungs nor in the heart, although he held that air is received into the mass of blood, but doubted « whether through the *Lungs* there be a *high way* for the Air to the Bloud. » « The *Lungs*, he saith, »— apparently following HARVEY— « serve chiefly, by their constant agitation to comminute the blood, and so to render it fit for a due circulation; which Office he thinks to be performed in Fishes by the continual motion of their Gills, a Succedaneum to Lungs. » (pp. 515-516). He mentions an experiment by LOWER on p. 510. (35)

§ 48. In the year 1667 also, JOHN SWAMMERDAM published his *Tractatus Physico Anatomico-Medicus de Respiratione usque*

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(32) ANTHONY à WOOD, *Athenae Oxonienses*, 1721, 2nd Edn., II, 612, 857, considered that LOWER's claim to the invention of transfusion could not be allowed because FRANCIS POTTER, whose mind had been put on the idea by OVID's story of Jason and the Golden Fleece, had previously entertained the notion. The credit for such a discovery as the transfusion of blood, is given, however, not for thinking of it, but for its successful accomplishment.

(33) In a letter (12 Nov. 1667) to BOYLE, OLDENBURG refers to some further anatomical work that LOWER was engaged upon (BOYLE's *Works*, 1744, V, 371a).

(34) There is a notice of the book in *Phil. Trans.*, Munday, September 23, 1667, vol. 2, pp. 509-516.

(35) According to GUNTHER (*loc. cit.*, III, 134) NEEDHAM had come from Cambridge to Oxford in 1660 to hear lectures by WILLIS and LOWER, the latter his senior by one year.

Pulmonum (36) in which are described a considerable number of experiments evidently carried out by the author himself, and several figures are shown in the frontispiece in illustration of some of them. Amongst these is a figure of a bellows containing inside, attached to the nozzle, the lungs of an animal, and regarding which Swammerdam « promises, if God wills to demonstrate visibly at some time to those interested these experiments which have already been enumerated, by means of a bellows made of glass containing within it the lungs of some animal removed from the body. » (37) This is, of course, merely BOYLE's experiment of the swelling up of a partially inflated bladder when placed in the receiver of a pump from which the air is gradually removed (*New Expts.*, Expt. IV, 1662, p. 25), but is quite a good illustration of the action of the thorax and lungs in respiration.

§ 49. In the same number of the *Philosophical Transactions* which contained this review of SWAMMERDAM's book, there appeared (p. 539) a paper which played a very important part in the elucidation of respiration, entitled, ***An Account of an Experiment made by M. Hook, of Preserving Animals alive by Blowing through their Lungs with Bellows.*** (38) This « noble experiment » consisted in displaying the thorax of a dog by cutting away the ribs, the diaphragm and the pericardium; pricking the outer coat of the lungs all over with a sharp pen knife, and then, by a contrivance of bellows, keeping the lungs constantly

(36) A notice of this appeared in *Phil. Trans.*, Munday, October 21, 1667, Vol II, No. 28, pp. 534, 535. The reviewer says, « In *short*, He makes *Respiration* to be a motion of the Thorax and Lungs, whereby the Air is sometimes impelled by the Nose, Mouth and Wind-pipe into the Lungs; and thence again expelled; farther to elaborate the Blood, by *Refrigerating it*, and by separating its *fuliginous steams*, and so raise it to its ultimate and highest perfection, for the Conservation of the Life of Animals. » ROBERT BOYLE refers to it in letters to OLDENBURG, (BIRCH, 1744, V, 252(a), 253(a).)

(37) « Quae jam enumerata sunt experimenta, *ope follis e vitro confecti, ac Pulmones alicujus animalis intra se continentis, extra corpus ad oculum demonstraturos* Curiosis, aliquando, si Deus volet, pollicemur. » (p. 39).

(38) This is referred to by OLDENBURG in a letter to BOYLE, Oct. 15, 1667. (BOYLE's *Works*, 1744, V, 369b). This experiment had been suggested by HOOKE three years earlier, November 2, 1664 (BIRCH, *loc. cit.*, I, 482), and carried out, perhaps in modified form, on November 9, 1664 (BIRCH, *loc. cit.*, I, 486). WALTER NEEDHAM opposed these views (BIRCH, *loc. cit.*, II, 272, 274, 281). See also § 36.

distended. The lungs were thus « always kept very full, and without any motion; there being a continuous blast of Air forc'd into the lungs... supplying it as fast, as it could find its way quite through the coat of the Lungs by the small holes pricked in it... The dog lay still... his Heart beating very regularly. » It appeared, therefore, that bare motion of the lungs, without fresh air, would not keep an animal alive, nor was it « the subsiding or movelessness of the Lungs, that was the immediate cause of Death, or the stopping of the Circulation of the Blood through the Lungs, but the *want* of a sufficient *supply of fresh Air*. » (p. 540).

§ 50. On Dec. 19, 1667, at the Royal Society, « Mr. HOOKE communicated an account of an experiment tried by him in the presence of Dr. LOWER... to see whether fœtus's live in the womb by their own or their mother's respiration »... « These experiments seem to hint, that the fœtus in the womb has its blood ventilated by the help of the dam » and « seem very manifestly to prove the continual and necessary communication of the blood of the dam with that of the fœtus, and of the immediate dependence of the one on the other. » (BIRCH, *loc. cit.*, II, 232; *M.* 217).

§ 51. On April 27, 1668, at the Royal Society, HOOKE remarked « that blood, though of a dark blackish colour, would, when exposed to the air, become presently very florid, and that florid surface being taken off, and the subjacent part exposed again, would acquire the like floridness; and that therefore it might be worth the observing by experiment, whether the blood, when from the right ventricle of the heart it passes into the left, coming out of the lungs, it hath not that tincture of floridness, before it enters into the great artery; which if it should have, it would be an argument, that some mixture of air in the blood in the lungs might give that floridness. » (BIRCH, *loc. cit.*, II, 274).

§ 52. As regards respiration, LOWER, thinking the diaphragm to be the organ most concerned in the motion of the lungs, examined the matter by severing the nerves controlling its action and found the whole manner of respiration altered, all the work being then thrown upon the intercostal muscles (39) which

(39) One of the claims made for MAYOW is to have shown that both the external and the internal intercostal muscles take part in expanding the thorax in respiration (*De Respiratione*, 1668, pp. 13-22; M., pp. 190-193). It is noticeable that in the above passage LOWER speaks as if he were already of this opinion.

« dilate the ribs much more than formerly » as when a broken winded horse is galloped. (40) (see § 61, 64). (*Phil. Trans.*, Monday, Novemb. 11, 1667, No. 29, p. 544. JOHN WARD's *Diary. Trans. Med. Soc. London*, 1920, **43**, 277).

§ 53. During the years after his graduation in law, and perhaps before it, MAYOW had been studying medicine. It seems not to be known exactly what his course was, but it is practically certain that he must have come under LOWER's instruction. This is accepted without question by GOTCH who says, without adducing any evidence, that some of the experiments of LOWER « attracted the attention of the thoughtful young MAYOW who witnessed them » (*loc. cit.*, p. 22), and by GUNTHER who says that MAYOW « studied anatomy with LOWER, WILLIS's chief assistant » (*loc. cit.*, I, 31), and « had had the advantage of assisting LOWER with his dissections and experiments » (*loc. cit.*, III, 136). This is indeed very likely, since LOWER had certainly been intimately associated with WILLIS, « whom » according to WOOD (*Athenæ Oxoniensis*, 2nd Edn., 1721, II, 857), « he helped, or rather instructed, in some parts of Anatomy, especially when he [WILLIS] was meditating his Book *De Cerebro* », which had been published in 1664.

§ 54. There is thus very definite proof that LOWER was working his way, by careful experimental investigation, through the phenomena of respiration, whereas there is no proof that MAYOW had done any research work on the subject at all. Within a short time of one another, however, they both published books, that of MAYOW preceding by a few months that of LOWER. Considering what we know of LOWER's previous work, it would be quite justifiable to deal with his book first, but to avoid even the slightest injustice to MAYOW, it will perhaps be better strictly to observe chronological sequence.

§ 55. In 1668, then, was published MAYOW's book entitled : *Tractatus duo Quorum prior agit De Respiratione : Alter De Rachitide. A Joh. Mayow, Coll : Omn : An : Socio. Oxon : Excudebat Hen : Hall, Impensis Ric : Davis.* 1668. There is no imprimatur.

(40) This is referred to in the *De Respiratione*, 1668, p. 25 : and ,with amplification, in M., p. 197, but without any mention of LOWER. See § 64. T. BARTHOLIN had apparently credited a good deal to the diaphragm. See BOYLE's Digression in *New Experiments*, 1662, p. 175.

The book is a small octavo. Copies bearing the date 1668 (41) are very rare; a further issue seems to have been made in 1669 as this date is found on the title-page of some copies which, however, bear the date 1668 on the title-page of the second tract. There is not a copy either of 1668 or 1669 in the British Museum. The Library of the Royal College of Surgeons of England possesses both, and I understand, by the courtesy of the Librarian, that they are identical except for the date. The Hunterian Library of Glasgow University has one of the 1669 copies. These title-pages are reproduced in Plates I and II.

§ 56. The first tract, *de Respiratione*—quite a short essay of about 5,500 words—occupies pp. 1-61 and there are two plates, the first consisting of Figs. 1, 2, 3 and 4 of Tab. 2 of the 1674 and A. C. R. editions. Tab. 2da is almost identical with Tab. 4 of the 1674 and A. C. R. editions except that Fig. 11, is slightly different at the points b, b.

§ 57. The second tract has a separate title-page (p. 63), p. 64 blank. *Tractatus secundus. de Rachitide. A Joh : Mayow, Oxon. Coll : Omn : An : Socio. Oxon : Excudebat Hen : Hall, Impensis Ric : Davis.* 1668, and is paged 65-108, the title-pages accounting for pp. 62, 63 and 64.

§ 58. The book was noticed (*Phil. Trans.*, November 16, 1668, No. 41, 3, pp. 833-835) either immediately after or immediately before (YEATS, p. XXXI), its appearance. At this time MAYOW was 25 years of age and that 2 ¼ pages out of 24, of which that issue of the *Phil. Trans.* consists, should have been devoted to so small a book by so young a man is, one would think, a sufficient proof that it received adequate consideration at the time of its publication. In view of GOTCH's and GUNTHER's animadversions on the writer of this notice, and also because a contemporary description helps us better to appreciate the opinions of the time, part of the review may be quoted, so that the reader may form a judgment on both points.

§ 59. « The Author in the former of these *Tracts*, having first given an account, how the Air by its *Elastick* force is inspired,

(41) BEDDOES (Preface iii, note) says he could never find the original edition of the second treatise (i.e. the *De Respiratione*), which accounts for some of his errors. YEATS and most, or all, of the later commentators quite evidently had never seen it either.

and upon the dilatation of the Chest, (42) caused by the intercostal Muscles, drawn upwards, rushes into the Lungs, which are thereby expanded, being nothing else but a Body made up of very thin little Membranes, in the form of innumerable small bladders; delivers his thoughts of the Use of Respiration, waving those opinions, that would have Respiration serve either to cool the heart, or to make the Bloud pass through the Lungs out of the right ventricle of the heart into the left, or to reduce the thicker venal blood into thinner and finer parts; and affirming, That there is something in the Air, absolutely necessary to life, which is conveyed into the Blood; which, whatever it be, being exhausted, the rest of the Air is made useless, and no more fit for Respiration. Where yet he doth not exclude this Use, That with the expelled Air, the vapors also, steaming out of the Bloud, are thrown out together. » (43) This gives an excellent idea of the contents of the first forty-three pages of the book. If the reader will compare it with the preceding part of this paper it will be evident that everything so far mentioned by MAYOW had already been dealt with either by BOYLE in his *Digression* or by HOOKE and LOWER in their published writings.

§ 60. The abstract then proceeds : « And inquiring, what that may be in the Air, so necessary to life, he conjectures, that 'tis the more *subtile* and *nitrous* particles, the Air abounds with, that are through the Lungs communicated to the Bloud : (44) And this *Aereal Niter* he makes so necessary to *all* life, that even the Plants themselves do not grow in that Earth, that is deprived thereof, which yet, being exposed to the Air, and afresh impregnated by that fertilizing salt, becomes fit again to nourish those Plants. » (45)

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(42) MAYOW here refers to the swelling of a partially inflated bladder in a receiver, on exhaustion (*De Respiratione*, 1668, p. 5; *M.*, p. 186. See §§ 48, 153).

(43) It is of some importance to show that this account is accurate, and therefore MAYOW's actual words which the reviewer summarises, may be quoted. In this case the last six lines are as follows in MAYOW :—« Quin ergo affirmemus, *ex aere inspirato nonnihil vitae prorsus necessarium, sanguini communicari;* quo, *quicquid sit, exhausto, inutilis factus est aer, neque amplius respiratoni idoneus.*

« Habet etiam *expiratio* ulteriorem usam, viz : *ut cum aero expulso, etiam vapores à sanguine exhalantes, simul exsufflentur.* » (*De Respiratione*, 1668, p. 43).

(44) « Et verisimile est, teniores esse, nitrosas particulas, quibus abundat aer, quae per pulmones sanguini communicantur. » *De Respiratione*, 1668, p. 43.

(45) At a meeting of the Royal Society on June 7, 1665, « Mr. HOOKE reported,

§ 61. The notice then refers to some others of MAYOW's opinions, e. g., that the aerial « *Niter*, mixt with the ***sulphureous*** parts of the Bloud, causeth a due fermentation, which he will have raised, not only in the Heart alone, but immediately in the Pulmonary vessels, and afterwards in the Arteries no less than in the heart. » (46)

§ 62. The reviewer also refers to MAYOW's opinion that « the Explosion, by which the muscles are so suddenly inflated and contracted » is due to the nitrous particles carried by the arterious blood amongst the fibres of the muscles, where they meet « the ***animal*** spirits, made up of a very volatile salt, and not much differing from the distilled spirit of bloud, highly rectifi'd » « by which mixture of a kind of *Volatile Spirit of bloud*, and a *Salin liquor*, united together, is caused that sudden explosion, and consequently the inflation and contraction of the Muscles.

« To which Ebullition, ***he saith***, may perhaps something also conduce the Bloud, forasmuch as its ***sulphureous*** particles, conjoyn'd with the *Niter* inspired, may render that juyce *Nitro-sulphureous*, and yet more explosive. » (47)

§ 63. It will be seen from this that MAYOW's *de Respiratione* is a succinct and fairly clear summary of views that had already been published by others; but that there is nothing new in the

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that he had sown some lettice-seed upon earth in the open air; and at the same time upon other earth in a glass-receiver, which was afterwards exhausted of air; that the seed exposed to the air was grown up an inch and an half high within eight days; but that in the exhausted receiver not at all : both which were produced and shewn the society. » (BIRCH, *loc. cit.*, II, 54). MAYOW's opinion may perhaps have been founded on HOOKE's experiment.

(46) « Quas autem in vita animali partes habet *nitrum hoc aereum* proxime inquirendum est.

« Et videtur nitrum hoc, partibus sanguinis sulphureis commixtum, fermentationem quandam debitam efficere, hujusmodi tamen accensionem in *corde solo* fieri haud existimo, sed statim in vasis pulmonalibus, & postea in arteriis non minus, quam in corde. » (*De Respiratione*, 1668, pp. 44, 45.)

(47) Existimare ergo liceat, particulas *alias nitro* salinas, ab aere inspirato procedentes, sanguinis arteriosi affluxu muscolurum fibras ubique inter fluere, easque incolere; *alias* autem, *spiritus* viz : *animales* ex sale admodum volatili constare, nec multum à spiritu sanguinis distillato, & ad summum gradum rectificato differre : *spiritus* hi, inquam, quoties motus obeundi gratia à nervoso genere amandati, prioribus illis *nitro salinis*, & diversi generis, particulis occurrunt, ex eorum veluti ex *spiritu sanguinis volatili*, & *liquore salino* unitis subitam illam explosionem, & per consequens musculorum inflationem simul & contractionem fieri verisimile est. » (*De Respiratione*, 1668, p. 51.)

views put forward. There was no novelty in the notion that something is taken out of the air in respiration—PARACELSUS had clearly expressed the idea; and MAYOW's statement that this something was nitre is distinctly inferior to HOOKE's notion of « a substance inherent, and mixt with the Air, that is like, if not the very same, with that which is fixt in Salt-peter. » (see § 44). Moreover MAYOW's idea of the action of this nitre—that it caused an effervescence not merely in the lungs, but in the heart and arteries as well—probably a reflection of LOWER's erroneous view of 1665 (see § 41)—was incorrect; whilst his notion that the expansion and contraction of the muscles was due to some kind of explosion due to this nitre was, at the best, extremely crude. Further, the subject of combustion is not dealt with at all, and there is not the very slightest suggestion of there being any second gas or vapour in the air.

§ 64. Another noticeable point is that although BOYLE, HIGHMORE and WILLIS are mentioned, MAYOW omits to give credit to other investigators of whose work his essay is a description. He does not mention HOOKE's name in regard to his « noble experiment » (§ 49) although he does say that it was performed in presence of the Royal Society. In especial, there is no mention of LOWER, (48) although at least three very important matters dealt with by him are cited. There is, in the first place, the fact that the diaphragm plays a very important part in respiration (see § 52). « Etiam *Diaphragma* pectoris dilatationi conducit; utique inspiratio *ordinaria* ab hoc ferè solo fieri videtur. » (*De Respiratione*, 1668, p. 23; *M.*, p. 197). Secondly, MAYOW makes a direct reference to the transfusion of blood in these words, « I think indeed, that if arterial blood impregnated with nitre came, instead of venous, to the heart, there would be no need of respiration. And this seems to be confirmed, because when arterial blood in an already well known experiment is transmitted into a dog; the dog, I say, although previously panting and breathing laboriously, after receiving the arterial blood scarcely seems to breathe. » (49) (see §§ 45, 46). Thirdly, MAYOW adopts

(48) It is of interest to observe how often NEEDHAM in his *De Formata Foetu*, 1667 (see § 47) mentions LOWER in connection with respiration (e.g., pp. 131, 138, 165), whilst MAYOW in 1668 does not mention him at all.

(49) « Etenim existimo, si *sanguis arteriosus*, & *nitro impregnatus* loco venosi,

the notion that had been erroneously expressed by LOWER that a fermentation takes place in the heart, changing venous to arterial blood (see § 60).

§ 65. Further, it ought rather particularly to be noticed that the account of MAYOW's essay of 1668 given in the *Phil. Trans.* is remarkably accurate, being couched, especially in the most important parts, in MAYOW's own words. As already mentioned, BEDDOES—who, however, only knew the 1674 edition—considered the *De Respiratione* to be the best of MAYOW's tracts, and this is a reasonable judgment. The essay is free from gross exaggeration and it seems to be so, simply because it is an account by MAYOW of a subject developed by others, by HARVEY, BOYLE, MALPIGHI, THRUSTON, HOOKE and especially by LOWER, and to which MAYOW, fortunately, and possibly through lack of time, added no embellishment of his own. If, however, one chooses to imagine that nothing had previously been done on the subject of respiration, and that MAYOW had performed all the experimental work on which the views mentioned are founded —which appears to be the general attitude of the commentators —then the *De Respiratione* might indeed be regarded as an epoch-making work; but it ought surely to be obvious from what has been said above, that there is not the faintest reason for thinking this to have been the case.

§ 66. MAYOW's essay was followed, early in 1669, by a book of genuinely first-rate importance, namely : *Tractatus de Corde. Item de Motu & Calore Sanguinis, et Chyli in eum Transitu.* Authore RICHARDO LOWER, M. D. Londini. Impensis JACOBI ALLESTRY, 1669. (50) See page 79. In this he detailed the work which had already established his reputation. The book deals, in five chapters, with :—the position and structure of the heart;

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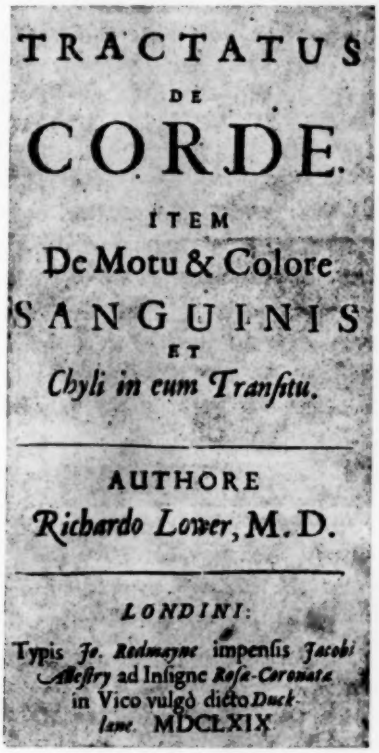
ad cor accederet, *nulla* omnino respiratione opus esse. Et hoc confirmari videtur, quod dum sanguis arteriosus noto jam experimento in canem transmittitur; canis, inquam, quanquam anteà *anhelus* & *laboriose* respirans recepto sanguine arterioso vix respirare videtur. » (*De Respiratione*, 1668, p. 59; *M.*, p. 218 where the passage is transferred to the third Treatise).

(50) It was republished in the same year at Amsterdam, Apud DANIELEM ELZEVIRIUM. Presented to the Royal Society March 4, 166 $^{8}/_{9}$ (BIRCH, *loc. cit.*, II, 353), a notice of it appeared in the *Phil. Transactions*, March 25, 1669, Vol. 4, No. 45 p. 909; and one of the third edition, *ibid.* July 17, 1671, Vol. 6, No. 73, p. 2211.

the motion and colour of blood; the transfusion of blood; chyle, and its transition and transformation into blood.

§ 67. In the third chapter, he showed that although it had already been stated that all the blood in the human body passes ultimately through the heart, the rapidity with which this occurs had been greatly underestimated. Taking the average capacity


TRACTATUS
DE
CORDE.
ITEM
De Motu & Colore
SANGUINIS
ET
Chyli in eum Tranſitu.

AUTHORE
Richardo Lower, M.D.

LONDINI:
Typis *Jo. Redmayne* impenſis *Jacobi Allestry* ad Inſigne *Roſæ-Coronatæ* in Vico vulgò dicto *Duck-lane*. MDCLXIX

Title page of Lower's *Tractatus de Corde* of 1669. From the Hunterian Library of the University of Glasgow. In the original the line above the word *Authore* is 65 mm. long.

of the left ventricle in man at two ounces, and the number of beats per hour at 2,000 (the lowest figure), 4,000 oz. or 332 lbs. of blood must pass through the heart per hour. Since the quantity of blood in a man (at a high valuation) is 25 lbs., it follows that all the blood in the body passes through the heart at least

thirteen (51) times per hour. This he confirmed also by a direct experiment in which the whole blood of a dog drained out through the heart in the twentieth part of an hour. This be thinks shows that there can be no profound difference between arterial and venous blood.

§ 68. He refers here also to opinions previously expressed by him (Vindication of WILLIS's Diatribæ, see § 41), saying he has changed the view he then held, and now believes that the diversity of colour between venous and arterial blood in no way depends on a fermentation of blood in the heart (p. 64), for, if it did, why should the colour in the two ventricles be different? That the scarlet colour is not communicated to the blood by the left ventricle, he demonstrated by cutting the larynx and inserting a cork in it so that no air could get to the lungs, when he found that the blood which flows from the cervical artery after suffocation is as venous in colour as that from the jugular vein. This is confirmed by the fact that the blood in the left ventricle and aorta of an animal which has been suffocated is always exactly like venous blood. Again, the dark coloured blood from the right ventricle of the heart of a strangled dog forced through the vessels of the (collapsed) lungs, returned from the pulmonary vein of a venous colour, whereas when the lungs were kept inflated and perforated (as in HOOKE's experiment) the blood, to the extent of pounds, came from the pulmonary vein, of a bright scarlet colour (p. 167). This production of the scarlet colour must be attributed wholly to the lungs («Atque hoc pulmonibus totum tribuendum est.» p. 166).

§ 69. He therefore corrects his earlier view that the blood from the pulmonary vein was venous, to which he had been led by an observation made after a hea third been expelled from the lungs, which were therefore no longer exercising their function; also he says that the opinion had been formed before he had learned from the experiments of HOOKE (to whom he acknowledges his indebtedness) that life could be long maintained by keeping the motionless lungs distended with fresh air. (pp. 167, 168). That the blood may be finely divided (comminuted) in the lungs

(51) The original has «six», but that there is a mistake here is pointed out in the *Phil. Trans.* review, *loc. cit.*, p. 911.

is true, but if this were the cause of the scarlet colour of arterial blood the fine vessels of other parts of the body should produce a similar effect. (p. 168, 169). « It appears therefore, that this scarlet colour is wholly due to the particles of air insinuating themselves into the blood since it is returned florid throughout, just as in the lungs; because in them the air diffused through all the particles of the blood is mixed more intimately with it. » (52) It is for this reason that the surface of venous blood exposed to the air becomes scarlet; and, if this surface be then removed by a knife, the newly exposed surface soon also becomes scarlet (see § 51); as is commonly known, venous blood shaken with air becomes scarlet. (p. 169).

§ 70. Then comes a passage of very considerable moment. Should he be asked, he says, « by what pores of the lungs the nitrous spirit of the air enters the blood and fully saturates it, » he would enquire in reply « by what gateways that other nitrous spirit of snow passes through dishes of delicacies and cools summer wine. » (53) (see §§ 39, 73). Thus, without any explanation, he attributes the action of the air not to nitre as MAYOW had done, but to a nitrous spirit of the air. This is, of course, much the same thing as HOOKE's « substance inherent, and mixt with the Air, that is like, if not the very same, with that which is fixt in Salt-peter. » (see § 44), but is an advance on it as regards terminology. It is, as far as I am aware, the first definitely published use of such a term, in connection with respiration. In addition, he attributes cooling to the absorption of this or a similar spirit, by one body from a colder one. This idea of the material character of heat and cold was common at the time and will be referred to again. (§§ 117, 119, 138 note).

§ 71. He adds « that since glass and metal are not impervious to this spirit, it should penetrate still more easily the softer vessels of the lungs. Besides, since the exit of fuliginous and serous

(52) « Praeterea calorem hunc rutilum particulis aeris sese in sanguinem insinuantibus omnino deberi ex eo satis perspicuum est, quod sicut in pulmonibus per totum floridus redditur; quia in illis aer per omnes sanguinis particulas diffusus cum ipso intimius permiscetur. » (p. 168).

(53) « Si per quos pulmonum meatus spiritus aeris nitrosus in sanguinem transit, eumque copiosius imbuit, à me quaeras, ostende & tu mihi quibus porulis alter ille spiritus nitrosus qui in nive est, per delicatulorum pocula transit & aestiva vina refrigerat. » (p. 169).

humours from the blood through the tissues of the lungs is admitted, surely the entrance of a nitrous food into the blood through the same or similar gateways may also be granted.» (pp. 169, 170). «Therefore it is very probable that the blood in its passage through the lungs extracts air and that to this admixture is entirely due its florid colour : moreover, after the air has again for the most part escaped into the structure of the body and the parenchyma of the viscera, and has transpired through the pores of the body, it is equally reasonable that the venous blood, deprived of it, immediately appears darker and blacker.» (p. 170). The importance of fresh air for breathing is thus clear; otherwise the filth of a prison should be as healthy as the pleasantest greenswards. Wherever fire burns easily there we may breathe freely. (pp. 170, 171). Surely it must be recognised that here we have the sound experimental work which definitely proved both that the change of venous to arterial blood in the body was due to absorption of air or something from the air, and that this absorption occurred in the lungs. The establishment of these, and other important facts, is clearly due to RICHARD LOWER, who also appears to have been the first to use the term *nitro-ærial spirit (spiritus aeris nitrosus)*.

§ 72. In 1664 MALACHIA THRUSTON (54) presented to the University of Cambridge a thesis running to 119 octavo pages with the following title :—*De Respirationis Usu primario Diatriba. Auctore Malachia Thruston, M. D. Accedunt Animadversiones, à Cl. Viro in eandem conscriptæ, una cum Responsionibus Auctoris. Londini Apud Johannem Martyn, Regalis Societatis Typographum ad Insigne Campanæ, M. DCLXX.* (55) Although this thesis was not published until 1670, it had been publicly disputed,

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(54) The only biographical accounts of THRUSTON which I have found are given by JOHN VENN, in *Biog. Hist. Gonville and Caius College*, 1897, I, 393; and in *Alumni Cantabrigienses*, 1927, Pt. I, IV, 241a. THRUSTON (b. ca. 1628), who was held in high esteem by his contemporaries, was elected and admitted a Fellow of the Royal Society May 24, 1665 (BIRCH, *loc. cit.*, II, 49). Two experiments, made by THRUSTON, were related by the bishop of Chester on October 29, 1668, to the Royal Society (BIRCH, *loc. cit.*, II, 316, 317). Shortly after his treatise was published, his mind failed, and he lived with relations in Somerset until his death on June 3, 1701.

(55) There is a notice of the book in *Phil. Trans.*, Feb. 17, 16 $^{69}/_{70}$, IV, No. 56, 1142. Presented to Royal Society, Feb. 10, 16 $^{69}/_{70}$, BIRCH II, 423.

and therefore it is quite possible that the ideas it contained became known, at least to some extent. Nevertheless we will take it merely at its date of publication. The thesis is interesting because it represents, partly, the older views of the Schoolmen and, partly, the transition to modern ideas.

§ 73. The most interesting passages in connection with the present subject are those in which he remarks, (1) that, as shown by the experiments of BOYLE, air has been given an elastic force : (2) that air of average constitution (mediocriter constitutum) is laden with nitrous particles, directing enquirers for further information—but without precise references—to the works of GASSENDUS, ENT, DIGBY and others. The properties of these particles depend on their figure and movement, and therefore can sometimes produce in different bodies, opposite effects; some considering them the cause of cold, others of heat. Sometimes they are supposed to make bodies denser and sometimes rarer, conclusions deduced by DESCARTES in the fourth part of his *Principia*. (3) Nature has limited the tenuity and thickness of the air, below or above which it is not suitable for respiration. (4) The purer, more subtle and penetrative part of the air when taken into the lungs is, as it were, lost, so that expired air is rendered vapid and, to a certain extent, effete; « nay more as I may well belive, the power of its elasticity is in great measure lost to it especially as it has been despoiled for the most part of that more mobile material. » (pp. 39-42; see on §§ 111, 116).

§ 74. It is also of some importance to notice here that in 1670 WILLIS published another book entitled *Affectionum quæ dicuntur Hystericæ & Hypochondriacæ Pathologia spasmodica, vindicata contra responsionem epistolarem Nathan Highmore* M. D. Lond. 1670, to which were added two other tracts entitled *Exercitationes Medico-physicæ duæ*. 1. *De sanguinis accensione*, 2. *De motu musculari*. The first arose out of a discussion with HIGHMORE, of which those interested will find some account in *Phil. Trans.*, December 13, 1669, IV, No. 54, p. 1089 and March 25, 1670 (56), V, No. 57, p. 1178. This book seems to be rare and I have not seen a copy of it, but in BLASIUS' edition

(56) Shortly after this, in 1670, July 5, MAYOW took his doctorate of Law. « He was now, and after, a profess'd physician. » (WOOD, *Fasti Oxonienses*, 2nd Edn., 1721, II, 181).

of WILLIS's *Opera*, 1682 at p. 21 (a) of this treatise, and in the corresponding part of the English Edition, 1681, p. 27, he speaks of a « pabulum nitrosum », a « nitrous food », supplied by the air, and (p. 21b ; p. 27) of « nitrosæ æris particulæ », « nitrous particles of the air », and that a mixture of sulphur and nitre will burn even under water. (p. 21b; 27, 28). He also refers to BOYLE's 41st experiment, which showed that air was necessary for life as well as for fire, « hence we may conclude, the life of a living Creature to be either fire, or something analogical to it » (p. 22b; 29) and he speaks of the necessity for the nitrous food drawn in from the air (p. 23a; 29, l. 13 from below). The immediate cause of the change of the colour of blood from a dark purple to a crimson is, he says, the « admixtion of the nitrous Air (æris nitrosi, p. 24a) with the Blood; which certainly appears, because the change into a crimson, begins in that place where the blood chiefly gets the access of the Air, *viz.* whilst it is transferred out of the Arteries into the Pneumonick Veins; for in those it appears of a dark Purple, in these every where florid, as the most Learned Doctor LOWER hath observed. » (p. 24a; 30). He also remarks that the heart is a mere muscle (24b; 31; *de Respiratione*, 1668, pp.47, 48; *M.*, p. 207), and says that there is an end both to fire and to life if the access of nitrous food be withdrawn (25a; 31).

§ 75. It is very important to notice these points, since MAYOW is usually credited with having been the first to put them forward (except about the heart being a mere muscle, as stated above) in his book of 1674, presently to be mentioned. By his contemporaries, the services attributed in modern times to MAYOW, were attributed, and rightly so, to BOYLE and to LOWER. As a proof of this it should be mentioned that in 1671 JOHN SWAMMERDAM's *Tractatus Physico-Anatomico-Medicus de Respiratione* of 1667, MALACHIA THRUSTON's *De Respirationis Usu primario Diatriba*, dated 1671; and MAYOW's *Tractatus duo*, dated 1671 were published together at Leyden; THRUSTON's tract bearing on the back of the title-page the note: « Libellum hunc hac formâ excudi curavimus, ut cum MAYOW et SWAMMERDAMII de Respiratione tractatibus, in unum volumen compingi possit. » (57), and MAYOW's an

(57) « We have provided this book in such form as might be bound in one volume with the tracts of MAYOW and SWAMMERDAM on Respiration. »

identical note with the substitution of 'THRUSTON' for 'MAYOW'. (58) It seems fairly clear therefore that MAYOW's *Tractatus duo* was quite well known to his contemporaries. By being published in this way it had an excellent chance of being judged along with other similar works. YEATS (p. 105, note) « cannot avoid remarking, as very singular, that in every work I have consulted, published in the time of MAYOW, no notice is taken of him. » The explanation is, quite evidently, that MAYOW's contemporaries were satisfied that the real advances on the subject of respiration up to that time had been made by LOWER, and comparison of the books mentioned above will show that the contemporary judgment was just. It is at least quite clear, that MAYOW's *Tractatus duo* added nothing novel to the subject of respiration and was, in fact, distinctly inferior to LOWER's *Tractatus de Corde* (1669) and WILLIS's *Affectionum quæ dicuntur Hystericæ &ct.* (1670).

§ 76. BOYLE had meantime been further considering the question of the generation of air and according to the Journal Book of the Royal Society, 1668, April 30, he then gave an account of experiments on the generation of new air or of the extrication of air lurking previously in several bodies, « at which time he mention'd also some ways of examining whether the substance thus produced be *true* air or not. » (*Phil. Trans.*, November 22, 1675, No. 119, X, p. 445, note).

§ 77. In 1668, presumably just after the appearance of MAYOW's book, ROBERT BOYLE published *A Continuation of New Experiments Physico-Mechanico, touching the Spring and the Weight of the Air, and their Effects*, (59) which dealt chiefly

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(58) The Library of the Faculty of Physicians and Surgeons of Glasgow possesses a volume, bound in contemporary vellum, containing SWAMMERDAM (1667); THRUSTON (1671); MAYOW (1671); an anonymous tract of twenty pages entitled *Novae Hypotheseos de Pulmonum Motu, et Respirationis Usu specimen. Lugdun Batavorum, Ex Officina Felicis Lopez, Anno MDCLXXI.* (This seems also to have been published at London. There is an account of it in *Phil. Trans.*, 1671, April 17, vol. 6, No. 70, p. 2141); LOWER's *de Corde* (ELZEVIR, 1669); J. C. PEYER's *de Glandulis Intestinorum* (Schafhusae, 1677) and NICOLAI STENONIS *Elementorum Myologiae Specimen*, (Amstelodami, 1669).

(59) This was noticed in *Phil. Trans.*, 1668, III, No. 42, Monday, Dec. 14, p. 845 (the next number after that in which MAYOW's *de Respiratione* had been reviewed).

with experiments connected with the air pump. In this year (60) BOYLE left Oxford and settled in London in the house of his sister CATHERINE, Lady RANELAGH, and in 1670 he published a number of papers entitled, *Pneumatical Experiments about Respiration ;* amongst them, *Some Experiments shewing, that Air, become unfit for Respiration, may retain its wonted Pressure. Phil. Trans.*, 12th September, 1670, V, No. 63, 2046. He included a pressure gauge in a closed vessel along with an animal, and noticed that after the animal had died from suffocation the pressure registered by the gauge had not altered. These were followed in 1671 by *Considerations touching the Usefulness of Natural Philisophy*, and, *Tracts... about... Cosmicall Qualities*, and in 1672 *Tracts... containing New Experiments, touching... Flame... Air... Explosions*, in which last he deals largely with the extinction of flame upon exhaustion of air ; the *difficulty of producing flame without air ; preserving flame without air ;* of the propagation of actual flame in vacuo Boyliano; and on *experiments about the relation betwixt air and the flamma vitalis of animals (where the time of life of a flame and an animal are compared)*. This kind of experiment had been carried out for years back. (Vide HOOKE's experiment of 166 $^2/_3$, § 35). He relates (p. 90) « an unprosperous attempt to make flame kindle camphire without the help of air » *(M.*, pp. 70, 71*)*, and (p. 114) discusses « the Duration of the Life of a burning Candle and Coal in our Vacuum. »

§ 78. In 1673 BOYLE's *Essays on Effluviums* was published containing also *Some Experiments to make Fire and Flame Ponderable*, in which he describes the calcination of tin and the accompanying increase in weight, which, he concluded, was due to *absorption of the material of fire which had passed through the glass.* This, although an erroneous conclusion, was by no means an unreasonable one on the existing experimental evidence—it might be called a reasonable wrongness, since, with the apparatus available at the time, it would scarcely have been possible to carry out experiments showing conclusively that air was concerned in calcination. (61)

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(60) In April according to GUNTHER, I, p. 18.

(61) It may be noted that MAYOW did not consider that *air* was concerned in the calcination of antimony (see §§ 128, 129).

In 1674 two more volumes of BOYLE's tracts were published, from of all which it will be seen how very prolific BOYLE was, whilst an attentive reading of MAYOW's later book, of 1674, will show how greatly he was dependent on BOYLE's experiments, most of which had been exhibited at the Royal Society, and presumably, therefore, would become known to the comparatively small number of people who were interested in such matters.

§ 79. In 1674 (62) MAYOW's second work was published. It was entitled *Tractatus Quinque Medico-Physici. Quorum primus agit DE SAL-NITRO, et Spiritu Nitro-Aereo. Secundus De Respiratione. Tertius De Respiratione Fœtus in utero, et ovo. Quartus De Motu Musculari, et Spiritibus Animalibus. Ultimus De Rhachitide. Studio Joh. MAYOW LL. D. et Medici:* (63) *Nec non Coll. Omn. Anim. in Univ. Oxon. Socii. OXONII, E Theatro SHELDONIANO. An. Dom. M.DC.LXXIV.* (64) There are 6 plates at the end of the book. Table 2 of the 1674 edition and A. C. R. 17, is similar to Tab. 1 of the 1668 edition, except that two new figures, 5 and 6, are included, whilst in Fig. 3, the small letters a, b, c are added. Tab. 4 in the new edition is almost identical with Tab. 2da of the first edition. There is a slight alteration in Figure 11 at the points b,b. The other tables are new and are as given in A. C. R. 17. The title-page is shown in Plate IV.

§ 80. The book has as frontispiece a portrait of the author which represents him to us as an attractive looking youth. It may be noted, however, that it was not customary at that time for portraits of living authors to be published in their scientific works. There is no portrait of BOYLE in any of his books issued during his lifetime; there is none of NEWTON in the *Principia*

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(62) WM. V. HARCOURT (*Phil. Mag.*, 1846, **28**, (3), p. 496, note) says the *Tractatus Quinque* was printed July 17, 1673. This is the date of the Imprimatur.

(63) This is erroneously translated by CRUM BROWN and DOBBIN as « By JOHN MAYOW, LL. D., M. D. » The phrase really means « By the zeal of JOHN MAYOW, LL. D. and a physician. » There is no indication that MAYOW ever took the degree of M. D.

(64) KOPP makes an astonishing mistake in his *Geschichte der Chemie*, 1843-7, attributing the *Tractatus quinque*, throughout, to the year 1669, e.g., III, pp. 14, 134 (note), 181, 186, 309 « Schon 1669 hatte dieser in seinem Tractat de sal-nitro et spiritu nitro-aëreo, » etc. KOPP may have confused the *Tractatus duo* dated 1669 with the *Tractatus quinque*.

or in the *Opticks;* none of HOOKE (unfortunately) in the *Micrographia*, nor of LOWER, THRUSTON, SWAMMERDAM in theirs. The publication of MAYOW's might be an indication of a certain self-satisfaction on the part of the author. The book has also a dedication to HENRY COVENTRY to whom, as already remarked, MAYOW was certainly indebted. The volume contains the two tracts, which had already been published, on respiration and on rickets. Three others are added, and the order in which the tracts are arranged is altered, pride of place being given to one entitled *De sal-nitro et spiritu nitro-aereo*, that on respiration coming second. The first three tracts are paged continuously up to p. 335, but the fourth and fifth tracts make up *Pars Secunda* and are paged separately up to p. 152.

§ 81. This rearrangement of the tracts in the 1674 publication causes, in itself, a good deal of confusion, because the reader is rather apt to imagine that MAYOW's views on respiration were derived from his views about nitre, whereas just the opposite is the case. It is therefore necessary to deal with these tracts, not in the order given, but, in the first place, to devote some attention to the new version of the *de Respiratione*—which bears on the title-page « Secunda Editio Auctior & Emendatior »—since it is in connection with this that the chief confusion has really arisen.

§ 82. The wording is altered to some considerable extent, moderately large additions being made here and there, whilst a few passages are transferred to the third treatise. It is not necessary to detail all the alterations, but some must be referred to. Perhaps the most important is that, whereas in the 1668 edition, MAYOW speaks only of nitre being contained in the air, he now adopts an expression practically identical with that used five years previously by LOWER, but which may have been in common use at the time, and speaks of nitro-aerial spirit instead, and then puts forward, and elaborates with mistaken ingenuity, in other parts of his book the ideas which had been mentioned by LOWER and THRUSTON about the cooling and heating and other effects of nitro-aerial spirit. (65) It is in this

(65) In the fourth tract he makes a rather belated reference to THRUSTON, « For it has been elsewhere shown (i.e., suggested) that the fermentation and

connection that some of the most serious errors have been perpetrated by MAYOW's commentators. They deny categorically that MAYOW had ever spoken of nitre being present in the air. Thus YEATS (p. 243) complains that SCHELHAMERUS and also FORSTER had attributed to MAYOW the opinion « that the air is full of nitre, and the nitrous particles is that part of the air, which is so necessary to the preservation of life », adding, « This is entirely a mistake, which it is *now*, we hope, unnecessary to correct. » BEDDOES (Preface XXXVI, XXXVIII) is equally emphatic. Both, in fact, are absolutely wrong. BEDDOES (Preface, III) mentions that he had never been able to find the original edition of MAYOW's work. YEATS, GOTCH and GUNTHER must have suffered from a similar disability, which, however, has not prevented them from making dogmatic statements about the *de Respiratione* of 1668 (1669), and even from contradicting other writers who had been more careful. It does not appear to have occurred to them that the second edition might be different from the first. MAYOW does, in fact, in the 1668 edition, speak solely about *nitre* being present in the atmosphere, but changed it to *nitro-aerial spirit* in 1674.

§ 83. GOTCH, as has been mentioned, attributed the apparent neglect of MAYOW by his contemporaries, to the *Phil. Trans.* reviewer who had « set forth his conceptions in such a crude way and in language so imbued with the traditional errors of the age, that they could not fail to produce an unfavourable impression upon the more acute intellects » (*loc. cit.*, p. 37;

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the motion of the blood are caused by nitro-aerial particles. And this has also been noted by the learned Dr. THRUSTON. » (*M.*, pp. 257, 258). This seems to show that MAYOW regarded his spiritus nitro-aereus as identical with THRUSTON's nitrous particles. Further MAYOW says nothing about THRUSTON's priority, nor of the fact that, whereas THRUSTON's idea was merely a guess, the proof in the matter, as far as it had gone at the time, was due to LOWER. It is a little difficult to avoid the feeling that MAYOW deliberately slighted LOWER, but in the *Tractatus quinque* MAYOW does make some reparation to LOWER by mentioning his name in a few places, e.g., *M.*, pp. 102, 103, where LOWER seems to be given the whole credit of having shown « that that change made in the mass of the blood is caused, not so much by its being triturated in the lungs as by the air being mixed with it »; also at *M.*, pp. 231, 232, which deal with the nature of muscular contraction; and at *M.*, pp. 290, 291, 293, in reference to the fact that the heart is a muscle. In connection with other advances due to LOWER, however, there is no acknowledgment.

see back §§ 17, 58-62), although the *Phil. Trans.* reviewer had, in fact, set forth MAYOW's conceptions in MAYOW's own words. (66) After quoting from the review of the *Tractatus duo* (see § 60), GOTCH says, « Here is the first misapprehension, for MAYOW does not use the term ‚nitrous', but ‚nitro-aerial,' or ‚igneo-aerial', in order to convey the idea that although the particles in the air exhibited some of the properties of nitre, their real significance lay in their being associated with combustion. Immediately following this misapprehension, a whole series of mistakes occurs in the abstract, which goes on to say, this aerial nitre he makes necessary to all life, and considering what part this nitrous air acts, he is of opinion that this nitre mixt with the sulphureous parts of the blood causeth a due fermentation.' Thus the author of the abstract now leads his readers to believe that MAYOW's conception was that the air contained the well-known substance called nitre, and that the intake of this nitre, by mixing with the sulphureous matter of the blood, produced a combustible mixture presumably like that of gunpowder » (pp. 35, 36)—which, of course, is exactly what MAYOW had said, see § 62.

§ 84. « The writer of the abstract then professes to give the pith of MAYOW's physiological views in terms which MAYOW himself would scarcely recognise, such, for instance, as the statement that the fermentation raised by the mixture of the nitre taken in with the sulphur of the blood is one ‚which he [MAYOW] will have raised not only in the Heart alone, but immediately in the Pulmonary vessels, and afterwards in the arteries no less than in the heart.' » « All this, » says GOTCH, « is a mere travesty of MAYOW's great work, and must have seemed

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(66) GUNTHER says, « it must also be remembered that the first accounts that appeared of MAYOW's work were abstracts printed in the *Philosophical Transactions*, which grossly misrepresented his views and misstated his discoveries » (*loc. cit.*, I, 33), and, « Owing to his early death, and partly, too, to the misrepresentation of his views in the unintelligent abstracts hurriedly drafted by HOOKE for the *Philosophical Transactions*, the transcendent merit of MAYOW's work was not recognised in Britain until it was rediscovered by Drs. BEDDOES and YEATS at the end of the eighteenth century. » (*loc. cit.*, III, 138). How it is known that these abstracts were hurriedly drafted does not appear, and it is almost certain that they were written by OLDENBURG—not by HOOKE. They were not unintelligent, and they did not in the least misrepresent MAYOW's views.

meaningless to the intellects of men like BOYLE. » (GOTCH, p. 36, see § 61 note).

§ 85. To state in this dogmatic fashion that a very accurate account of an author's work, couched largely in that author's own words is such a travesty of his ideas that he himself would scarcely have recognised it, is surely the last word in inept criticism. But when GOTCH says that it must have seemed meaningless to men like BOYLE, he ingenuously stumbles on the truth. MAYOW's work, when it was not merely a restatement of that of others, was, in fact, meaningless or, at least, entirely unconvincing to his contemporaries. GOTCH wonders why these mistakes of the reviewer were not corrected (p. 37); the answer of course, is very simple—they were not corrected because they were not mistakes. The fact, however, that GOTCH considered MAYOW's own words to be a travesty of MAYOW's ideas, shows that GOTCH imagined MAYOW's ideas to be quite different from what they actually were, and at the same time he rather naïvely justifies the attitude of MAYOW's contemporaries, by the implicit admission that MAYOW's views would have been meaningless even to GOTCH.

§ 86. GOTCH thinks that MAYOW would scarcely have recognised, as representing his views, the statement that the fermentation of the nitre with the sulphur of the blood takes place « not only in the Heart alone, but immediately in the Pulmonary vessels, and afterwards in the arteries no less than in the Heart. » (p. 36). But, as has already been stated, these are MAYOW's own words; and not only in the *de Respiratione* of 1668, *but also in that of* 1674, so that GOTCH does not seem to have studied the *Tractatus quinque* either, with ordinary care. It is the fact that even five years after the publication of LOWER's *de Corde* (see §§ 66-71), in which the mechanism of respiration was definitely and adequately proved up to a certain point, MAYOW's views were still erroneous and much behind LOWER's.

§ 87. This confusion of the *Tractatus duo* with the *Tractatus quinque*, and the quotation, by commentators, of passages of the latter as if they had occurred in the former, has done much harm; but in addition to this, the commentators credit MAYOW with advances due to others. Both of these are exemplified in the following instances.

§ 88. Thus YEATS (p. 83) quotes MAYOW (from the 1674

edition) as follows : « Concerning the use of respiration, therefore, we may reasonably conclude, that an aerial something, whatever it may be, absolutely necessary to support life, passes into the mass of blood ; thence air thrown out from the lungs, from which the vital particles are exhausted, is no longer fit to serve the purpose of respiration, » and adds, « MAYOW seldom hazards an opinion without the rigid test of experiment, and here he adduces one in proof of his doctrine. (c) If the lungs of a dog be inflated by a pair of bellows, in such a manner that the air may pass through perforations made in them, which is immediately to be supplied by the bellows, lest the lungs should collapse ; in this case, I say, the dog will live. » « No other conclusion, » says YEATS, « could be drawn from these experiments and observations, than that which MAYOW made ; the inferences were perfectly just, and warranted the opinion founded upon them. » (p. 84).

§ 89. The impression here conveyed, especially by the statement that MAYOW seldom hazards an opinion without the rigid test of experiment, is, that we are indebted to MAYOW himself for these observations and conclusions ; but, in fact, the experiment quoted by MAYOW is merely a description of HOOKE's experiment, (see § 49) which, indeed, is indicated in the 1668 *de Respiratione* (see § 64) by the reference to the experiment having been carried out in the presence of the Royal Society. It is true that the conclusions drawn from these experiments and observations were indeed just ; but they belong to HOOKE, not to MAYOW, to whom, in this surprising fashion, YEATS does not hesitate to transfer the whole credit.

§ 90. Further, speaking of MAYOW's *de Respiratione* of 1668, YEATS (pp. 100, 101, 134) quotes, again from the 1674 edition, MAYOW's opnion « that if arterial blood, which is impregnated with the nitro-aerial spirit, could be conveyed to the heart, instead of venous, there would be no occasion for respiration », and also MAYOW's reference to an experiment in this connection which has already been mentioned (§ 64) ; « Whilst arterial blood is transfused from one dog into another, although the dog, into whom the blood is injected, is panting and breathing deeply, yet upon receiving the arterial blood into his veins, he scarcely seems to breath. » In an appendix about this (p. 383), he quotes a « Letter from Dr. BEDDOES, concerning an experiment

made by MAYOW, » but in the next paragraph says that it is *mentioned by* MAYOW. It cannot be asserted that this experiment was not performed by MAYOW, but from the facts that LOWER, who was undoubtedly the first to perform transfusion experiments, considered the experiment a very difficult one, and that MAYOW says it was already well known when he was only 25, it seems highly improbable that the experiment was MAYOW's. BEDDOES, however, attributes it to MAYOW without any hesitation. (67)

§ 91. GOTCH (p. 23) regarding this experiment says that MAYOW, « who evidently witnessed it » « was greatly impressed », but there is in fact no evidence that MAYOW « evidently witnessed it » and MAYOW says nothing about being « greatly impressed. » MAYOW's statement is embroidered with the product of GOTCH's imagination. GUNTHER (*loc. cit.*, III, 136), apparently following GOTCH, on account of this passage says that MAYOW « was almost certainly present at one of LOWER's transfusion experiments, » but curiously enough this does not seem to suggest to either of them that MAYOW owed, not only this idea, but probably all his other ideas on respiration that were of any value, to LOWER.

§ 92. A further example of both these types of confusion, and one of the most completely misleading, is furnished by a remark of GOTCH which has already been quoted in § 16. It is re-echoed by GUNTHER as follows :—« In 1668 he published the *Tractatus de Respiratione*, in which he showed that air was a mixture of two kinds of gases, the one, *spiritus nitro-aereus*, necessary both for combustion and for respiration, and the other incapable of supporting combustion and respiration, which was left after the removal of the *spiritus.* » (*loc. cit.*, I, 31). GUNTHER adds that this was « the practical discovery of oxygen. » (68) In Vol. III of the same work, p. 137, he says,

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(67) (*Analysis*, p. 47 and *Observations on Calculus, Sea Scurvy*, etc., 1793, p. 104 where he calls it « A very delicate observation made by MAYOW ».

(68) In BLACK's *Lectures on the Elements of Chemistry*, 1803, I, 428, the absurd statement is made that « Dr. MAYHOW of Oxford, in 1674 » « collected the nitro-aerial spirit, as he called (p. 553, it bladders spited on the MAYHOW is not more same volume, however, out in note 31), it is stated that « of the retort. » In the explicit [than HOOKE], and certainly had never made any chemical experiments with the air obtained from nitre, which he seems to call the *nitro-aereal* spirit. »

« In his twenty-eighth year he published his first book, the *Tractatus de Respiratione*, 1668, in which was first clearly stated the existence of a special gas in the air necessary both for life and combustion. »

§ 93. Now in the tract of 1668 MAYOW says nothing whatever about spiritus nitro-aereus; he does not show and never did show, but definitely denied (see on § 114) that air was a mixture of two kinds of gases—he speaks only, as already remarked, of *nitre* in the air; and if this achievement was what GUNTHER calls it, « the practical discovery of oxygen », this great discovery over which SCHEELE, PRIESTLEY and LAVOISIER laboured, it should seem, so unnecessarily, belonged not to MAYOW, but to HOOKE or perhaps some one previous to HOOKE. But, in fact, the *De Respiratione* does not deal with combustion, and GUNTHER not merely confuses MAYOW's two separate publications of 1668 and 1674, a procedure absolutely fatal to any proper comprehension of the manner in which the subject developed about that time, but credits him with an idea (69) which he certainly did not hold; besides, in the last passage, making a new suggestion as to MAYOW's age.

§ 94. BEDDOES is guilty of exactly the same error. Of this so-called « discovery » of nitro-aerial spirit, he says, « He who discovers new things necessarily brings upon himself the task of inventing new names. ... [MAYOW] calls the great principle which he has pursued so far through nature... vital salt... fire-air particles... nitro-aerial spirit is another name frequently used. » (Preface, pp. XXVII-XXIX). Similarly, YEATS says, « He denominates that part of the atmosphere which supports combustion, Fire-air Particles... and nitro-aerial spirit. » « We see here MAYOW forming a nomenclature for himself, the just result of his experiments. » (*loc. cit.*, pp. 8, 9). All this in spite of the fact that MAYOW did not invent the term nitro-aerial spirit, which had been used five years before him by LOWER. (see § 71).

§ 95. YEATS (Sect. 7, p. 103) discusses to some extent contemporary views on respiration and is compelled to admit —but only implicitly—that SWAMMERDAM, THRUSTON and LOWER

(69) That of there being two gases in the air. See on §§ 114, 115.

understood the relationship between air and life a number of years before MAYOW wrote. He states (*loc. cit.*, p. 105) that « In THRUSTON's publication, we find ideas very similar to those we at present entertain, with respect to the use of respiration. He seemed to be aware of the great connection between air and life, and of the dependence of the one upon the other. » In a note to this (*loc. cit.*, p. 105) he says that THRUSTON held the opinion that respiration is to warm the blood « an opinion first proved by MAYOW, in his beautiful experiments. » But he omits to mention how and when this was 'proved' by MAYOW, or which were the beautiful experiments in question. All that one finds on the subject in MAYOW's 1668 tract, is the *assertion* that « this nitre, mixed with the saline-sulphureous particles of the blood, excites in it the necessary fermentation, » (70) and I know of nothing more precise in the *Tractatus quinque* unless it be his reference to the fact that « vitriolic Marchasites and the like » if exposed « when recently dug up, to moist air, they will shortly effervesce and become intensely hot, in as much as aerial particles give rise to a very pronounced effervescence when they meet with the saline-sulphureous particles of the mineral. » (*M.*, p. 104). Referring to THRUSTON's idea that air contained nitrous particles and that the « more pure, more subtle, and more penetrating part, is absorbed by the lungs, » YEATS says, « How similar, with some exception, is this, to the reasoning of MAYOW. Were the experiments of MAYOW, before publication, noised abroad, so as to suggest these ideas to THRUSTON; or did opinions, like these, beginning to prevail at that time, from observation, rouse the genius of MAYOW, to institute experiments to confirm the truth of them ? » (pp. 106, 107).

§ 96. Now, as already remarked, MAYOW's tract of 1668—four years after the presentation of THRUSTON's Thesis—does not mention, explicitly, experiments of his own on the subject of respiration, and if he had performed any experiments that were going to influence THRUSTON in 1664, they would have had to be made when MAYOW was about 20 years of age, and

(70) Et videtur *nitrum hoc*, partibus sanguinis sulphureis commixtum, fermentationem quandum debitam efficere, hujusmodi tamen accensionem in *corde solo* fieri haud existimo, sed statim in vasis pulmonalibus, & postea in arterius non minus, quam in corde. » 1668, pp. 45, 46; *M.*, p. 206.

almost before even LOWER had begun to carry out his experiments on the colour of blood and on transfusion. It does not seem to have occurred to YEATS that it is vastly more probable, taking all the circumstances into account, that THRUSTON's and LOWER's views and experiments had become known to MAYOW and that MAYOW had taken it upon himself to describe them in print. Further it is more then likely that here again YEATS is darkening counsel by confusing MAYOW's 1668 *de Respiratione* with the 1674 publication, in which latter a few experiments partly by MAYOW and partly by other investigators are mentioned, but how THRUSTON in 1664 was to know what experiments were going to be described by MAYOW in 1674 is certainly not clear.

§ 97. It may also be noted, as showing how MAYOW incorporated in his book other people's ideas without mentioning the source, that in Table 2 of the *Tractatus quinque* (which had been Table 1 in the 1668 edition), Fig. 6, illustrating the mechanism of respiration, shows a bellows, one cover of which should be of glass, whilst inside is a bladder so attached to the nozzle that when the « bellows are opened by drawing the blades apart, the bladder swells and extends into the enlarged cavity of the bellows. » (*M.*, p. 187). Although this is obviously identical with SWAMMERDAM's idea already referred to (§ 48), BEDDOES attributes it to MAYOW, who, he says, « offers this as an elucidation of the manner in which the lungs are inflated. » (*Analysis*, p. 43).

(To be continued.)

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27 *June* 1930.

Un Journal inédit de Hooke. *

J'ai déjà eu l'occasion ici-même (1) de signaler l'existence d'un journal inédit de HOOKE (1635-1703) à la Library of the Corporation of the City of London. Ce diary, que j'ai retrouvé en novembre 1928, n'a été mentionné par aucun auteur encore. Rien d'étonnant à cela, puisque le document fut mis en 1708 seulement entre les mains de RICHARD WALLER, trois ans après que cet ancien secrétaire de la Société Royale eût publié, en tête de son édition des œuvres posthumes de HOOKE (2), une Vie de l'auteur de la *Micrographie* qui est la seule biographie originale que l'on possède jusqu'à présent. (3)

Le diary — un volumineux registre dont les feuilles ont environ 24 × 36 cm. — est catalogué à la bibliothèque du Guildhall sous le nº 1758 (Dr. HOOK's Journal); il ne m'a pas été possible de démêler à la suite de quelles circonstances il se trouve actuellement à l'hôtel de ville de Londres (4). L'écriture de HOOKE, très serrée, embrouillée, souvent illisible, ne couvre qu'environ

* Depuis que cet article a été écrit, Mr. R. T. GUNTHER a fait paraître ses deux importants volumes : *The Life and Work of Robert Hooke*. Je prie le lecteur de bien vouloir se reporter au compte-rendu que j'en donne d'autre part (pp. 174-7), où l'on verra dans quelle mesure il convient de modifier ce qui est dit ici relativement au manque de travaux critiques sur HOOKE.

(1) JEAN PELSENEER : Une lettre inédite de NEWTON, *Isis*, nº 38, mai 1929, pp. 237-254.

(2) *The Posthumous Works of* ROBERT HOOKE... *containing his Cutlerian Lectures and other discourses...* published by RICHARD WALLER... London, 1705.

(3) WALLER, dans sa Vie de HOOKE, a fait allusion à un diary à deux reprises : Posthumous Works, pp. XXV et XXVIII. Mais, s'il s'agit chaque fois du même diary — ce qui n'est malheureusement pas indiqué — la date (18 juillet 1696) d'un des passages dont parle WALLER prouve que le document qu'il a consulté n'était pas le diary qui fait l'objet du présent article.

(4) On peut toutefois rappeler qu'après l'incendie de 1666, HOOKE fut un des deux city-surveyors et joua, semble-t-il, un rôle actif dans la reconstruction de la cité. Il aurait même eu l'occasion d'amasser un bien considérable dans ses nouvelles fonctions (cf. *Posthumous Works*, pp. XII et XIII).

125 pages du registre, c'est-à-dire une faible partie de son épaisseur. Le journal, commencé le 10 mars 1671/2 — deux mois après l'élection de NEWTON à la Société Royale (11 janvier 1671/2) — s'arrête brusquement à la date du 15 mai 1683. Bien qu'il soit tenu avec négligence et que son aspect soit sale et désordonné, le souci d'y noter quotidiennement tout ce qui a intéressé l'auteur est évident. Il y a une quantité incroyable d'items et le nombre d'auteurs cités est très considérable.

Mr. WALTER ADAMS, de University College, Londres, et moi-même avons l'intention d'éditer cet important manuscrit. Je vais tâcher d'indiquer brièvement ici pourquoi je crois que seule une publication intégrale en est possible et désirable.

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Voici plus de deux siècles que rien de nouveau n'a été dit sur HOOKE. Jamais encore un bilan complet de son œuvre scientifique n'a été dressé. Depuis la biographie due à WALLER, aucune étude d'ensemble n'a été esquissée, aucun document de quelque importance n'a été révélé (5). Il est permis d'espérer qu'à l'occasion du prochain tricentenaire de la naissance du savant anglais (1935), un travail de quelque envergure verra le jour. Pour cette mise au point, le diary du Guildhall sera indispensable, outre le fait qu'il constituera une source quasi inépuisable de renseignements inédits.

Afin de souligner l'importance du diary, rappelons en deux mots ce que fut l'activité de HOOKE pendant la période de onze années que couvre son journal.

La première moitié du diary correspond à l'époque des démêlés avec HÉVÉLIUS, HUYGENS, NEWTON (à propos de la nature de la lumière) et OLDENBURG; c'est à ce moment aussi que HOOKE découvre la diffraction de la lumière, qu'il publie ses travaux sur les lames minces, qu'il entreprend ses recherches sur la parallaxe des étoiles et qu'il travaille à la théorie de la gravitation et à la

(5) Les nombreux articles historiques ou d'encyclopédie qui ont paru ne sont que des résumés de l'étude de WALLER, dont ils se bornent souvent à reproduire des passages entiers. On trouvera cependant une bibliographie assez étendue des travaux de HOOKE dans : JOHN WARD; *The Lives of the Professors of Gresham College*, 1740, pp. 169-193.

théorie du magnétisme terrestre. Il faut ajouter qu'un certain relâchement se constate durant toute cette période dans l'activité de HOOKE à la Société Royale, comme conséquence de ses démêlés avec OLDENBURG dont la mort survint en 1677; d'où l'intérêt spécial de la première moitié du diary.

Quand HOOKE écrit la seconde moitié de son journal, il exerce les fonctions de secrétaire de la Société Royale (depuis le 30 novembre 1677). Il publie les *Philosophical Collections*. De cette période datent les nouvelles séries d'expériences sur le rôle de l'air dans la respiration et dans la combustion (6), les expériences sur la déviation des graves, et le mémorable échange de lettres avec NEWTON (7), les travaux sur la théorie cinétique des gaz et la théorie de l'élasticité (8), les observations de comètes, notamment en 1680 et 1682 (9), etc....

Le journal fourmille de récits pleins de vie; on y trouve des renseignements et des indications de toute sorte; il abonde en détails personnels souvent très intimes et fournirait les éléments d'une psychographie certainement unique en son genre. J'ai toutefois l'impression que son intérêt réside ailleurs.

Il ne faut pas oublier en effet que HOOKE fut en relations étroites avec presque tous les savants anglais de son temps. C'est en cela que son journal apparaît comme un document d'une grande importance pour l'histoire de la science en Angleterre dans la seconde moitié du XVII[e] siècle. Il est à consulter par tous ceux qui étudieront l'atmosphère scientifique à l'époque newtonienne, car, comme je l'ai déjà dit, les auteurs cités sont innombrables. (10) Il est intéressant au surplus de faire remarquer ici que le nom de NEWTON n'apparaît ni dans le diary de PEPYS (1 janvier 1660 — 31 mai 1669) ni dans celui d'EVELYN. En un certain sens

(6) Les tentatives antérieures de HOOKE dans ce domaine auraient suffi à le mettre au premier rang des initiateurs en physiologie. Cf. WILLIAM S. MIDDLETON : « The medical aspect of ROBERT HOOKE ». (*Annals of Medical History*, 1927, pp. 227-243.)

(7) Dans mon article déjà cité, (note 1), j'ai essayé de donner la substance de cette correspondance dont le rôle fut capital dans la genèse des *Principes*. Depuis la publication de mon travail, une lecture attentive des œuvres de HOOKE m'a persuadé que le rival de NEWTON ignora tout de l'analyse infinitésimale.

(8) La première conception scientifique de l'élasticité est due à HOOKE, (1679).

(9) La comète de 1682 n'est autre que la comète de HALLEY.

(10) C'est là une des raisons de l'inutilité d'une édition partielle.

d'ailleurs, le journal de HOOKE prolonge le diary de PEPYS, qu'il dépasse par le nombre d'années sur lesquelles il s'étend. Il le complète et semble en représenter l'équivalent dans le domaine de la science.

Il sera peut-être possible au lecteur de se convaincre de l'intérêt du diary de HOOKE par le passage suivant, qu'il m'est agréable de pouvoir reproduire. Mr. H. W. ROBINSON, attaché à la bibliothèque de la Société Royale, qui a déjà étudié avec beaucoup de soin le manuscrit depuis que je lui en ai signalé l'existence, avait été autorisé à publier le fragment ci-dessous, mais, avec une courtoisie à laquelle j'ai été très sensible, il m'a prié de donner moi-même cet extrait au public. Qu'il en soit ici remercié (11) :

« Fr (12). Drank Choc. wth DAVYS & SCARBOROUGH to Mr. MONTAINE. walkd into his upper apartment smokd at YOUNGS. BOYLE abroad D (13) at Sr CH. WREN's. bedashd by Sr. CH: WR. coach at ye enterance of Pall mall. At Mrs STORY (14). Mr PAGE. (15) Mr BOYLE Monr. (16) ZULICHEMS creature. Saw at SLAYERS. ye grinding ye edge of glasse true to a plate for excluding air. Concluded at Sr. CH: W. wth Dr. HOLDER. the beginning of a clubb for N. P. (17) & mechanicks. — I was to speak. to. Sr. J. MORE. Mr. WILD. Mr. HILL. Mr. HOSKINS.

(11) HOOKE eut-il l'habitude de tenir un journal toute sa vie durant ? Différents indices tendraient à nous le faire supposer. On savait déjà, grâce à WALLER (*Posthumous Works of* ROBERT HOOKE, p. 1), qu'il avait commencé (10 avril 1697) une autobiographie dont il ne semble malheureusement pas subsister de traces aujourd'hui. Or, voici que Mr. ROBINSON m'a annoncé la découverte — faite par lui au British Museum le 8 juillet 1929 — d'une suite au journal de 1671/2-1683. Dans une lettre ultérieure (15 juillet 1929) Mr. ROBINSON a bien voulu me donner les précisions suivants : « I noticed under PETIVER's name in the Sloane collection : » « Diary 1688-1693—4024. » Upon looking at this I at once noticed that » it was HOOKE's handwriting. The entries are very similar to those in the diary » at the Guildhall, but the volume is totally different. The British Museum » diary is simply composed of a number of very small leaves, each of which has » been mounted on a guard. The leaves are badly arranged and are all out of » order. The volume is nicely bound, but is entirely wrongly lettered « J. PETI- » VER's Diary. » The diary has an abrupt beginning and an equally vague ending. » This leads me to suppose that earlier or later leaves have been lost. »

(12) Friday.

(13) Probablement : dined.

(14) Illisible.

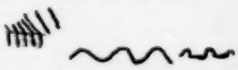
(15) Id.

(16) Id.

(17) Natural Philosophy.

Mr. HENSHAW. & Sr. CHR. brought Dr. HOLDER. at GARAWAYS. THOMPION a clownish churlish Dog. I have limited [?] him to 3 day and will never come neer him more. Mr. AUBREY here at 11. pp. (18).

JANUARY. I. 1676. S (19). missd short grace. at GARWAYS. till 12 in Great Rome. D. H. to Mr. HILL. Dr. WHISTLER. Mr. WILDE. wth Mr. WILD met HILL at mans to Sr CHR. WRENS. We now began our New Philosophicall Clubb (20). and Resolved upon Ingaging ourselves not to speak of any thing that was then reveald sub sigillo to any one nor to declare that we had such a meeting at all. We began our first Discourse about light upon the occasion of Mr. NEWTONS Late Papers. I shewd that Mr. NEWTON had taken my hypothesis of ye pulse or wave. Sr. CH: WR. explaind his way thus.



and upon speaking further thus but I shewd that twas a double puls moving together the one a stronger or quicker and the other a weaker or slower puls. that it Depended upon ye thickness of the plated body that I could produce & compound Colours. by thinness & thicknesse only. both by Reflection from ye two surfaces & by transmission through them. Next I told them of my Selesnoscope [sic] wch. I had already made use of these 6 monthes. made by Reflection from ye Superficies of glasse. I told them of one I had made of 50 foot focus. & of my making one of 30 f. I told them how strangely cleer it represented All ye parts of ye moon both those of ye limb and those of the middle parts at all times and even in a full moon Distinct. I argued for water in ye moon and that the under parts of ye sea were seen as well as the dips of hills. & alledged my experience of seeing ye bottom of ye sea from ye top of a high Clif that could not be seen at ye top of ye water. Sr. CH: affirmd noe water nor River nor cloudes. mountains not like ours nor vales. [Q: whether ye water hath not wholy covrd ye face of our Earth and whether it doth not wast by passing ye (21)] Mr. WIND came in. Discoursed of Passing over morasses on floats of tubbs & of Hurdles. of Spurs fastned into the heels

(18) Post prandial.
(19) Saturday.
(20) Aujourd'hui, le Royal Society Club, selon Mr. ROBINSON.
(21) Illisible.

of shoes to walk up or down hill on ice and mud told of others which were commonly tyed under the Sole like a cross wth. fowr teeth at ye ends. ⋊ to walk in frosty weather used in Holland. of making works wth straw frozen together in a night or two by water thrown on them and of passing trenches. and of others secured from Scating by freezing ye outer edge in ye same manner. & making them Slippery. Dr. HOLDER came in. Discoursd of making body kindle each other by mixturs. I Related ye heating of ♃ terebinth upon mixture and out of barthg-line of the fixing of ♄ of Turpentine. I undertook to have it tryd. Mr. WILD told of the fellow that kindled tow in his mouth. mention made of the fellow that hold the Red hot iron in his teeth seen by ye RS. I told them of ye way of making lightning in ye playhouse & Sr. CH: of ye way of thunder by a ball falling in ARCHIMEDES screw sett up right about 12 foot high. upon which much was Discoursed about ye strength of gunpowder & lightning. I asserted lightning to be made by such subterraneous steams as Rise from ye Burning well in Lancashire Raisd by ye heat of ye air and Kindled alone. Sr. CH: & Mr. HILL affirmd noe bullet to be shot a mile. he instanced in shots tryd from Dover cliffs off to sea. that a Demi culvering shot almost as far as ye long Basilisk. & neither of them a mile. affirmd noe hill a mile high. mentiond a mountaine where one river ran (22) miles one way and but (23) miles the other side. Mr. WIND went: after this sub sigillo I mentiond [mention made of seeing in ye Dark of The shining of fish slime and of shining of the juice of the Scolopendra worm. Dr. HOLDER affirmed that the worm would Shine in the Dark when alive which I had never found but when it was Kild. Sr. CH. affirmd, that the outside of oysters had strange motions visible of the light farther to be observed.] that all plants were femalls. that their wombs were impregnated by insects either bred on them or otherwise flying in ye air at their season of blowing. that there was upon every great plant a herball of smaller plants microscopicall growing on them & a heard of various animalls microscopicall, ranging among them. objections were made that those animalls were male & femall

(22) Illisible.
(23) Id.

& produced their like and that plants were likewise esteemed soe but not Insisted on. Dr. HOLDER supposd that insects did poyson ye Leaves. but I affirmd that the Leaves & ye plants themselves were the matrices or rather nurses of the fetus of Insects. I mentioned also the preservation of bodys by exhausting ye air. upon which Discourse was had of the living of plants by air and water. Mr. WILD mentiond his tryalls of plants seald up in glasses. that they grew (24) a good while, that that grew longest that stood in the Sun. mention was made that noe flesh would by corruption produce Insects wthout ye eggs of (25) Insects and Sr. CH: told ye Bishop of Chester Experiment of covering the glasses wth. tiffany & wth. paper. and exposing it to the air open. the first would produce some on ye tiffany. ye. 2d. none. ye 3d many on ye flesh. upon Parting I declared my new way for the orthography of musick to be discoursd more next meeting.—we rose at 9. by coach to Ludgate we met Mr AUBREY at childs & stayed till 11. coledge gate lockd. eat meat & drank chocolat that Rectifyd stomack & made me sleep well.

Sun. (26) Jan: 2d. rose at 9 1/2. AUBREY here. Drank warm ale. sm: 2 pipes. wrote yesterdays account. COX demanded for 60 foot glasses. 40ll but was willing to take 15. & 5 for microscopes. D H. (27) began new Journall of Club.—At coffe house shewd Mr. HILL.—Could not sleep after Choc: till eating salt beef. at 2 in ye morn. Slept well. ☿.»

Harvard University. JEAN PELSENEER.

P. S. Mrs. Dorothea Waley SINGER, que j'ai eu l'honneur de rencontrer tout récemment à l'Université de Californie, m'a dit qu'elle connaissait le journal de Hooke depuis plusieurs années déjà, l'ayant trouvé au cours de ses recherches dans les bibliothèques londoniennes. Toutefois, elle n'a jamais rien publié à ce sujet, ce qui excuse mon ignorance de sa découverte.

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(24) Illisible.
(25) Id.
(26) Sunday.
(27) Dined home.

The Influence of French Mathematicians

at the end of the Eighteenth Century upon the teaching of Mathematics in American Colleges

1. French influence began to make a perceptible impression in the United States shortly after the beginning of the War of Independence. The American Academy of Arts and Sciences was founded in 1780. Its founders had placed upon record the statement that it was their intention « To give it the air of France rather than that of England and to follow the Royal Academy rather than the Royal Society. »

2. A list of names of men prominent during the period of the French Revolution would contain the leaders in mathematics whose works had a very great influence upon our American science. The effect upon the progress in subject matter could be traced only by a much longer study than has been possible in this one and by a scholar with a far more intimate acquaintance with progress in mathematics in this country than the present writer. The effect upon the mathematics of the colleges of the first half of the 19th century and even well into the latter half of it is, however, pronounced and directly traceable through textbooks and courses of study.

3. The greatest names of this period are those of LAGRANGE, LAPLACE, and LEGENDRE who have been called « the great trio ». JOSEPH LOUIS, Comte LAGRANGE (1736-1813) was recognized during his lifetime as the greatest living scholar in his science. Among the many honors which came to LAGRANGE, we shall speak only of his call to become a professor at the École Normale Supérieure in 1795 and at the École Polytechnique in 1797. These schools were a part of the educational activity during the French Revolution, an activity which exceeds that of any other period

in history. I quote from LAKANAL (1) the attitude in the choice of professors for the former. « For the first time men the most eminent in the whole range of science, and of the most talents, men who, up to the present time, have been teachers of nothing less than nations and ages, men of genius, are going to be the first masters of a school for the people, for you will admit into these chairs none but men who are called because of unquestioned eminence throughout Europe... Here it shall not be the number who shall serve but the superiority. It is better that they be few, but that they be the elect of science and of reason. » While the principles of the École Normale were long in being even approached in any American center, yet the Normal school movement instituted at this time spread to the American continent and has eventuated in the great teachers colleges of graduate standing today.

4. The École Polytechnique, according to an article written by a French scientist in 1803, had a triple aim, to prepare engineers for different branches of service, to spread abroad in civil life enlightened men, and to encourage talented persons who could advance the sciences. The professors chosen were the most celebrated in France as well as the greatest scholars in Europe. « To each school LAGRANGE was called and to each he gave a mathematical impulse that it never lost. » (2) Each school thereby established a tradition of sound mathematical training, like PLATO of old, as the basis of all its work.

The École Polytechnique furnished a model for the United States Military Academy at West Point, a model followed afar off but, nevertheless, an inspiration. The purpose in founding the Military Academy was very different from that of the earlier American Colleges. Mathematics was all important here but not outstanding elsewhere. This was one of the centers from which learning in the United States spread. The influence of Superintendent Thayer (supt. 1817-1833) on the course of mathematics was far-reaching. CHARLES DAVIES, whose name will be mentioned again, recognized this in the inscription of one of his books : « To Lieutenant-Colonel S. THAYER,... In the organization of

(1) Quoted in A. J. LADD. *École Normale Supérieure. An historical Sketch*, p. 12, 1907.

(2) DAVID EUGÈNE SMITH. *History of Mathematics*, Vol. I, p. 485, 1923.

the Military Academy under your immediate superintendençe, the French methods of instruction, in the exact sciences, were adopted; and near twenty years experience has suggested few alterations in the original plan.

The introduction of these methods is considered an improvement worthy to form an era in the history of education in this country; and public opinion has justly appreciated the benefits which you have conferred, at once on the Military Academy, and on the cause of science. »

Direct use of any of the writings of LAGRANGE in this country has been found only at the Lawrence Scientific School in 1842 where his *Mécanique Analytique* is included as a course offered by Professor BENJAMIN PEIRCE.

5. Associated with LAGRANGE as a professor of mathematics at the École Normale was PIERRE SIMON LAPLACE (1749-1827). In an address before the American Association for the Advancement of Science in 1880 by ASAPH HALL, we find these words : « But theoretical astronomy was soon to receive a wonderful advancement. Perhaps no one contributed more powerfully to this progress than LAGRANGE. The writings of this man are models of simplicity and elegance; and yet so complete and general are his investigations, that they contain the fundamental theorems of celestial mechanics... To supplement this great theorist, there was needed another kind of genius. Combining the highest mathematical skill with unequalled sagacity and common sense in its application, LAPLACE gathered up and presented in a complete and practical form the whole theory of celestial mechanics. »

6. LAPLACE's *Traité de Mécanique Céleste* has been characterized as « undoubtedly the greatest systematic treatise ever published » (3) It appeared in 5 volumes and a supplement (1799-1825). This great work was translated into English by an American, NATHANIEL BOWDITCH (1773-1838). It appeared in Boston, 1829-1839, although the translation of the first volume was accomplished from 1815 to 1817. *The Mathematical Diary*, a publication conducted by ROBERT ADRAIN, has a suggestive reference to the « American *Mécanique Céleste* ». It is found in a selection (4)

(3) R. S. WOODWARD. The Century's Progress in Applied Mathematics in *Bulletin of the American Mathematical Society*, Vol. IV, p. 134.

(4) *The Mathematical Diary*, Vol. II, p. 298f, 1825-1832.

entitled : « Horae Decerptae. From a Mathematician's Diary », and reads : « There has been a fluttering among the stooled pigeons of Europe at this achievement of our countryman ; and the automata professors there begin to open their eyes at last to see what has been snatched from them. »

Perhaps the statement (5) of Professor EDWARD S. HOLDEN, astronomer and fifth president of the University of California, that the translation of the *Mécanique Céleste* marks the beginning of an independent mathematical school in America is an overestimate of its influence. It is true, however, that at that time, very few persons in the country could have read the original work with understanding. BOWDITCH's translation and his careful and complete notes elucidated the work and brought it within the grasp of students as well as calling it to their attention.

A passing regret must be voiced that BOWDITCH did not devote his really great abilities to mathematical research. Had he done so, he might truly have inaugurated original work in the field of American mathematics at the very beginning of the 19th century. A reading of his life reveals the fact that he anticipated more than one educator and mathematician of today in turning aside from professional openings, as professor of mathematics at Harvard, at the University of Virginia, at West Point, for the more remunerative opportunities of business.

The translation of BOWDITCH has an immense amount of additional subject matter in it. He had many letters (6) from his contemporaries in Europe in recognition of this. « M. LEGENDRE, in a letter dated at Paris, July 2, 1832, says, ' Your work is not merely a translation with a commentary; I regard it as a new edition, augmented and improved, and such a one as might have come from the hands of the author himself if he had consulted his true interest, that is, if he had been solicitously studious of being clear,... ' Mr. BESSEL, also, in a letter dated at Königsberg, Feb. 18, 1836, writes : ' Through your labors on the Mechanism of the Heavens, LA PLACE's work is brought down to our own

(5) EDWARD S. HOLDEN. The Beginnings of American Astronomy in *The Smithsonian Report for* 1897, p. 104.

(6) NATHANIAL BOWDITCH. *Mécanique Céleste. By the Marquis de LaPlace. Translated by Nathaniel Bowditch*, Vol. IV, Memoir of the translator by his son, NATHANIEL INGERSOLL BOWDITCH, p. 62ff, 1839.

time, as you add to it the studies of geometricians since its first appearance. You yourself enrich this science by your own additions, for which special obligations are due to you.' »

7. The part played by BENJAMIN PEIRCE in the translation of LAPLACE's work should be stressed. PEIRCE was a graduate of Harvard in 1829 and later tutor and professor in that college. He was *the* first American mathematician. Early in life, he became acquainted with Dr. BOWDITCH and maintained with him a strong friendship throughout the life of the latter. His regard is expressed in the dedication of his *Analytic Mechanics* as follows : « To the cherished and revered memory of my master in science, NATHANIEL BOWDITCH, the father of American geometry, this volume is inscribed. » Dr BOWDITCH's translation was revised in the process of publication by Professor PEIRCE. Whenever 120 pages were printed, Dr. BOWDITCH had them bound in a pamphlet form and sent them to Professor PEIRCE who, in this manner, read the work for the first time. PEIRCE used Vol. I of this translation in a course offered at Lawrence Scientific School in 1848.

To PEIRCE is due also the introduction of the methods of GAUSS, BESSEL and STRUVE in the United States. (7) Following up the lines of investigation laid down by LAPLACE in a work chiefly theoretical was not so essential to progress in celestial mechanics as were perfecting the methods and increasing the data of observational astronomy. (8) Success in these fields must be attributed to the German mathematicians and astronomers already mentioned. That American astronomy was due to LAPLACE in its beginnings is unquestioned. That, in time, it used the results of German discoveries was along the line of progress in European countries.

8. We turn now to the third great name associated with LAGRANGE and LAPLACE, that of ADRIEN MARIE LEGENDRE (1752-1833). The name of LEGENDRE is not so well known to the layman. His achievements in the realm of mathematics did not approach those of his two compeers, although these were considerable. Among them were advances in geodesy which

(7) EDWARD S. HOLDEN, *loc. cit.*, p. 107.
(8) R. S. WOODWARD, *loc. cit.*, p. 148f.

he brought about in the early 19th century. « The name of LEGENDRE is famous in geodesy by reason of his beautiful theorem which makes the solution of a geodetic triangle almost as easy as the solution of a plane triangle. » (9) Among his own countrymen, he did not achieve the popularity accorded to the other two men. This may have been due to his own personality. He sought recognition which apparently came unsought to both LAGRANGE and LAPLACE. In letters of his, now in the collection of Professor DAVID EUGENE SMITH, LEGENDRE asks of LAVOISIER (April 17, 1785) that he be considered « dans la Classe de géométrie à la place de Mr. MÉCHAIN ». In another letter, he asks that he be included in the number of scholars and artists who have « logement aux galeries du Louvre. » The name of LEGENDRE was known, however, to a great army of college and school boys of the 19th century in this and other countries, young people who had never heard of LAGRANGE and LAPLACE.

9. The work of LEGENDRE which influenced geometry for nearly a century was his *Éléments de Géométrie — Avec des Notes*. It was published in Paris, the second year of the Republic, 1794. DELAMBRE in his *Rapport sur les progrès des Mathématiques depuis* 1789 (to 1808) states that M. LEGENDRE restored geometry to its old rigor, and gave some new ideas for treating some parts in a purely analytic manner. Geometry, the oldest of the branches of mathematics, offered little opportunity for progress, but the 17th and 18th century authors of elementary books recognized imperfections in the works in their hands. To the English school, the order of EUCLID was absolutely indispensable to rigorous demonstration and they bent their efforts towards purging the text of faults which had crept in during the lapse of time and the incapacity of copyists. Such an English mathematician was ROBERT SIMSON. The French, on the other hand, sacrificed a rigor which seemed to them meticulous for the sake of an order which would better serve to fix the propositions in the minds of their students. ARNAULD of Port Royal, the Great ARNAULD, published in 1667, his *Élémens de Géométrie* with later editions in 1683, 1692, 1711. Interest attaches to the final impulse which led to the writing of these Elements. PASCAL, a great friend

(9) R. S. WOODWARD, *loc. cit.*, p. 142.

of ARNAULD, showed him one day a work which he had written on EUCLID's Elements. This work did not please ARNAULD because PASCAL had retained the faults of sequence which are present in EUCLID. PASCAL laughingly challenged the Doctor to make a better. ARNAULD accepted the challenge and at the earliest opportunity worked out a new sequence which was incorporated in his text. (10)

A number of texts appeared in France during the 18th century, texts which got farther and farther away from being demonstrative geometry. LEGENDRE then in 1794 undertook to revive in France a taste for rigorous demonstration. He formulated a new order, « à-peu-près l'ordre d'EUCLIDE », introduced some new definitions, distributing them « dans le courant du livre » as they are needed, and clarified proofs. He states, however, in the preface to this edition that he has followed closely the method of the *Elements* of EUCLID and that of the *Sphere and Cylinder* of ARCHIMEDES, thereby being the first to coalesce these two. The notes placed as an appendix to the text include a nice discussion on the foundations of a method for treating geometry analytically. He holds that the ancients who did not have the instruments of algebra attained results with remarkable dexterity but that it would be a great mistake for us who have them not to make use of them. The notes which showed LEGENDRE to be a true geometer added greatly to the praise which the other part merited.

LEGENDRE's Geometry had a prodigious success not only in France but in foreign countries, as shown for instance by the twenty editions in the French language before the death of the author in 1833. One edition noted, by M. A. BLANCHET, a work adopted by the University, appeared in Paris in 1873, although no claim is made that this was the last appearance of the text. In America, LEGENDRE completely supplanted EUCLID as a textbook in geometry as will be shown.

10. The first translation in English of LEGENDRE's *Éléments de Géométrie* was made by JOHN FARRAR (1779-1853), Hollis professor of mathematics at Harvard from 1807 to 1836. The

(10) KARL BOPP. ANTOINE ARNAULD, der grosse ARNAULD, als Mathematiker in *Abhandlungen zur Geschichte der Mathematischen Wissenschaften*, Vierzehntes Heft, p. 183f, 1902.

title reads : *Elements of Geometry, by A. M. Legendre,... translated from the French for the use of the students of the University at Cambridge*, New England. It appeared in 1819 and was followed by five other editions in 1825, 1829, 1830, 1831, 1835. The 1819 translation was made from the 11th French edition of 1817 [and contains the *Traité de Trigonométrie*].

FARRAR follows LEGENDRE in placing the diagrams together at the back of the book. He numbers paragraphs consecutively, 555 in all, and « Section » replaces « Book », changes which found no favor in other quarters. He makes certain omissions, including most of the notes. A minor point is the statement that « a trapezoid has two only of its sides parallel », an incorrect translation of « le trapeze dont deux côtés seulement sont parallèles ».

Biography does not show the influences exerted on FARRAR which resulted in this work. He had a share in the educational reform that took place in this country from 1820 to 1830. The regard in which he was held by men of science in his day is shown by a notice which appeared after his death in the Proceedings of the American Academy of Sciences [Vol. III, p. 38ff] of which he had been a member since 1808. This reads « Not the least important of the services rendered to Science by Mr. FARRAR was the translation and introduction into general use in the American Colleges of the best French textbooks in Mathematics, and Physics or Natural Philosophy; which prepared the minds of teachers and pupils for a system of instruction in those branches superior to that which had hitherto been imitated from the English universities... Professor PEIRCE alluded in terms of admiration to the important services rendered to mathematical science by Mr. FARRAR and ascribed to him, more than to any other man, the adoption of the present admirable system of instruction in the mathematical sciences. » Thus the impetus given to mathematical reform by such authors as LEGENDRE was felt in this country at the outset through JOHN FARRAR. This and other treatises were adopted for instruction not only at Cambridge, but at the United States Military Academy and other principal institutions throughout the country. The copy of the 1819 LEGENDRE in the New York Public Library contains « JOHN S. PATTERSON's, Miami University, Ohio, 23d May 1828, JOHN S. PATTERSON Sophomore Class Yale College, October 1830. »

11. The next translation of LEGENDRE in English to appear was *Elements of Geometry and Trigonometry with notes. Translated from the French of M. A. Legendre.* Edited by DAVID BREWSTER, LL. D.,... with notes and additions and an introductory chapter on proportion. Edinburgh, 1822. No mention was made in this publication of the translator, THOMAS CARLYLE. In a letter (11) of CARLYLE's dated November 17, 1821, we find : « I saw BREWSTER the other day, who received me kindly and spread out his bank draft for fifteen guineas like a man. He told me further that a translation was *for certain* to be set about, and that I as certainly should have the first offer of it. The work is a French one, LEGENDRE's , Elements of Geometry ' : » The completion of the work in the Spring of 1822 is recorded by his biographer as follows : « The LEGENDRE was well done—so well that he was himself pleased with it. ' I still remember [he says] a happy forenoon (Sunday I fear) in which I did a Fifth book (or complete Doctrine of Proportion) for that work. Complete really and lucid, and yet one of the briefest ever known. It was begun and done that forenoon, and I have, except correcting the press next week, never seen it since; but still feel as if it was right enough and felicitous in its kind. I got only 50 £ for my entire trouble in the LEGENDRE, and had already ceased to be the least proud of mathematical prowess. ' » Some two years later CARLYLE met LEGENDRE and was taken to a sitting of the Institute where he saw LAPLACE and LACROIX and POISSON and met DUPIN.

BREWSTER says definitely in the « Preface of the Editor » : « my intention of superintending an English translation of his LEGENDRE's *Elements of Geometry...* » His connection with the work merely as editor seems to have been lost sight of because he is frequently referred to by later writers as the translator. This text has the diagrams in the body of the work and follows other English customs in the printing of Euclid.

12. In 1828, six years after the BREWSTER first edition, there appeared in New York City, *Elements of Geometry with notes translated from the French of A. M. Legendre...* By DAVID BREWSTER, LL. D... Revised and altered for the use of the Military Academy

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(11) Quoted in JAMES ANTHONY FROUDE. *Life of Thomas Carlyle*, Vol. I, p. 111, 1882.

at West Point, New York. Published by JAMES RYAN. Other editions were 1830, 1832. The « Preface to the American Edition» states : « The alterations made are chiefly in the texts of the propositions. In the original work, as well as in the translations of Dr. BREWSTER and Professor FARRAR, the propositions are not enunciated in general terms, but with reference to, and by the aid of, the particular diagram used for the demonstrations... the Editor... ventures the alterations he has made, notwithstanding that the other method has been followed by the eminent author and his distinguished translators ». This edition was used at West Point in 1832.

JAMES RYAN assembled several textbooks, although he seems to have been a publisher and bookseller and not a scholar in any sense whatever. « *An Elementary Treatise on Algebra...* To which is Added An Appendix... by ROBERT ADRAIN » ran through eight editions from 1824-1847 and was widely used. RYAN published *The Mathematical Diary* during the period that ADRAIN was conducting it. He contributed a « Question » to the first issue (1825) and the editor, thinking that he needed to be accounted for, gave a footnote (12) to this question : « This gentleman is the author of an ingenious and useful work lately published entitled, , An Elementary Treatise on Algebra, practical and theoretical; adapted to the instruction of Youth in Schools and Colleges '. » RYAN conducted the *Diary* from 1828 to 1832 at which time he had acquired an A. M. degree. A reference (13) to him is found in the « Horae Decerptae. From a mathematician's diary. ' The Editor certainly deserves our thanks for his patriotic and unpaid labours and exertions to advance the mathematics among us. ' » [He had expended some $1500 of which only $500 came back in subscriptions.]

13. The work of BREWSTER was used by another textbook maker whose name became almost a household word during the middle of the 19th century. The year 1834 marked the appearance of *Elements of Geometry and Trigonometry. Translated from the French of A. M. Legendre.* By DAVID BREWSTER, LL. D. Revised and adapted to the course of mathematical instruction

(12) *The Mathematical Diary*, loc. cit., Vol. I, p. 22.
(13) *The Mathematical Diary*, loc. cit., Vol. II, p. 298f.

in the United States, by CHARLES DAVIES... Other editions were 1838, 1842, 1844, 1845, 1847, 1848, 1849, 1850, 1851, 1853, 1855, 1856, 1857, 1858, 1861, 1862, 1864, 1866, 1868, 1871, 1872, 1873, 1874, 1876, 1878—Edited by J. H. VAN AMRINGE, 1882, 1890 making 28 editions located. The influence of Professor VAN AMRINGE of Columbia University added to the long life of LEGENDRE and other French writers in this country. Upon the LEGENDRE edited by him was based all the elementary instruction at Columbia in solid geometry and plane and spherical trigonometry down to his retirement some twenty years ago.

There is strong internal evidence that DAVIES took over the RYAN text without mentioning the man unless the suspicion may be entertained that DAVIES prepared the RYAN work of 1828. It was not DAVIES's way to hide his light under a bushel and one is inclined to the former view. Certainly the texts have much in common. The passage already read from the preface of the earlier work is reproduced in the later one, as are several others, either verbatim or with slight alterations. A novel feature of the DAVIES's Legendre is « *An Index*. Showing the propositions of LEGENDRE which correspond to the principal propositions of the first six books of EUCLID. » [Taken from 1845 ed.]

14. The editions of LEGENDRE did not cease with the contributions of DAVIES. The DAY and THOMSON's Series took advantage of the popularity of this author and we find : *Elements of Geometry : on the basis of Dr. Brewster's Legendre...* By JAMES B. THOMSON, A. M., 1844, with five editions to 1855.

15. Enough has been given already to show an extensive use of this geometry. There may be added Amherst, 1821, LEGENDRE in the original, [Taken from the list in the library of the college] and others which are appended shortly. This study has been made largely from original sources. The facts which follow, however, are taken from : *The Teaching and History of Mathematics in the United States*, by Professor FLORIAN CAJORI, 1890, a work which presents extensively the courses of study in American Colleges. FARRAR's Legendre was used at the University of Alabama in 1833 and was followed by DAVIES's Legendre in 1843; the DAVIES work was used at South Carolina in 1836, 1858; Dartmouth, 1839; Kentucky, 1848 (?), 1859-1890 or later; Mississippi, 1854, 1866, 1872 followed by the VAN

AMRINGE edition in 1888; Bowdoin, 1867, displaced by WM. SMYTH's books; University of Michigan (no date); North Carolina, 1872; Yale, 1870 where it competed with PLAYFAIR's EUCLID until 1885 when Euclid as a textbook was discarded; Virginia Military Academy (no date) followed by F. H. SMITH's Legendre.

16. GASPARD MONGE (1746-1818) was a leader second only to LAGRANGE, LAPLACE and LEGENDRE in making France a great mathematical center in NAPOLEON's day. He held a position as professor in the École Polytechnique which gave him an opportunity to lecture on the theory of descriptive geometry. His treatise upon it : *Géométrie descriptive. Leçons données aux Écoles normales, l'an 3 de la République...* 1799 was the source of *A Treatise on Descriptive Geometry for the use of the cadets of the United States Military Academy.* By C. CROZET, Professor of Engineering in the Academy... New York, 1821. CLAUDE CROZET, a graduate of the École Polytechnique came to the Academy through Major THAYER's agency. He was one of several French engineers who became associated with West Point after the American Revolution. Crozet introduced descriptive geometry not only there but throughout the country. His book was taken over by DAVIES in his *Descriptive Geometry* (1826). In 1851, there appeared *An Elementary Treatise on Statics by Gaspard Monge...* Translated from the French by WOODS BAKER, A. M... 1851.

17. France produced other great makers of textbooks during this period. These books were early recognized as extremely valuable for instruction in this country and the translation and publication of them deepened the French influence on American mathematics. We present the most conspicuous works. LOUIS PIERRE MARIE BOURDON (1779-1854) was a mathematician who taught at the École Polytechnique. He was not a man of genius but his exposition was remarkable for its clarity and he deserves a place among the popularizers of the science. His first work : *Éléments d'Algèbre* (1817) was his outstanding one. It was so well done that it caused an early writer on the work in mathematics at West Point to say : « The foundation for analysis is well laid by the study of that prince of algebraists, BOURDON. »

18. The first American writer to use BOURDON was WILLIAM SMYTH whose *Elements of Algebra* was published in Portland

in 1830 with five other editions to 1850, viz. 1833 (2), 1836 (3), 1846 (5), 1847 (6). It was immediately adopted at Bowdoin College in which SMYTH was located as professor of mathematics. Under « Notice », the author says : « In the preparation of the work free use has been made of the Algebra of LACROIX and BOURDON. The whole has been written anew, as has been found by experiment to be well adapted to the business of elementary instruction. »

19. Two translations of BOURDON's Algebra by American teachers appeared in the same year, 1831. One has the title : *Elements of Algebra, by Bourdon, translated from the French for the use of colleges and schools.* It was published in Boston and contains no clue to the translator beyond the rather circumstantial one that the publishers were HILLIARD, GRAY, LITTLE and WILKINS, which firm published the other books in the Cambridge series. The translator of the latter series was JOHN FARRAR, already cited. No reference to the use of this text or to other editions of it has been located. In the *Mathematical Diary* (14) we find under « Horae Decerptae—From a Mathematician's Diary ».

« The latest mathematical works.

« Let us read over the list : Translation of M. BOURDON's Algebra... by Professor FARRAR of Harvard (Footnote. Cambridge, Mass., 1831) and by Professor De MORGAN of the London University (London, 1828). » This seems to settle the matter of the translator. The preface says that considerable use has been made of a translation by Professor DE MORGAN, and it is dated Cambridge, July, 1831. FARRAR had included in a series of *Notes* appended to a work on the calculus which he produced in 1824 one entitled : « On the Method of Indeterminate Coefficients. From BOURDON's Algebra », showing that he had the book in use seven years before this translation was made.

20. The other translation is entitled : *Elements of Algebra translated from the French of M. Bourdon for the use of the cadets of the U. S. Military Academy.* Translated by EDWARD C. ROSS, New York, 1831. Lieutenant ROSS was graduated from West Point in 1821, and was assistant professor of mathematics from 1821 to 1833, with a break of a few months. He was later professor

(14) *The Mathematical Diary*, loc. cit., Vol. II, p. 296.

of mathematics and natural philosophy at the Free Academy, New York City (now College of the City of New York.) This work was immediately adopted as a textbook at West Point and soon thereafter at the University of the City of New York, Union, Princeton, Geneva and Kenyon Colleges. It became the foundation of DAVIES's Bourdon.

21. In 1835, there appeared *Elements of Algebra. Translated from the French of M. Bourdon. Revised and adapted to the course of Mathematical Instruction in the United States.* By CHARLES DAVIES, New York, 1835. [Not 1834 as given in Allibone.] Later editions appeared in 1835, 1836, 1837, 1838, 1839, 1840, 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1853, 1858, 1859, 1860, 1870, 1875, twenty-two editions, and this list cannot be regarded as exhaustive. In 1844, « including STURM's theorem » came into the title. After 1850, « HORNER's theorems » entered and the work was designated « on the basis of M. BOURDON ».

CHARLES DAVIES (1798-1876) was a graduate of West Point in 1815. From 1816-1837, he was professor of mathematics there. Later he was associated with Trinity College, Hartford, and from 1857-1865 with Columbia University. Professor DAVIES is especially well-known because of his series of textbooks. G. W. CULLUM (15) says of him : « he has made his mark on the educational system of this country quite as much, if not more than any man in his generation... it was also the production of the best textbooks on the exact sciences, which have gone into the schools and academies and colleges of our country... » His Legendre and Bourdon with revisions and modifications continued in use at the Military Academy for over sixty years. The first essays of DAVIES into the field of textbook making seem to have been based directly upon the work of other American writers, with no statement to that effect. This has already been pointed out to have been the case with his Legendre and it is equally true of his Bourdon. As time went on, however, he showed himself to be a textbook maker of great expertness. Serious criticism was early levelled against the too general practice of

(15) G. W. CULLUM. *Biographical Register of the Officers and Graduates of the U. S. Military Academy*, Vol. I, p. 151ff, 1891.

merely translating foreign works. In the *Mathematical Diary* (16) some writer says : « Our elementary works on the pure and physico-mathematical sciences, have savored too generally of a foreign mint. It would certainly be more creditable to us as a nation, and becoming us as an independent people, to rely less upon bald translations and compilations of and from transatlantic publications, and more upon our own exertions. We ought and must think for ourselves, and if we cannot advance anything new, we may at least be original in disposing and arranging the materials of science. » CHARLES DAVIES was very successful in doing the latter.

BENJAMIN PEIRCE, in starting a series of textbooks with his *Algebra* (1837) pays tribute to two of the authors immediately preceding and to French methods as follows : « The excellent treatises on Algebra, which have been prepared by Professor SMYTH and Professor DAVIES, containing as they do the best improvements of BOURDON and other French writers, would seem to leave nothing to be desired in this department of mathematics... the investigation of each proposition has been conducted according to the French system of analysis. »

22. GEORGE PERKINS, Principal and Professor of Mathematics in Utica Academy brought out an algebra in 1842 with, at least, three later editions, in which the greatest credit for his work is given to BOURDON's Eighth Edition. Both Legendre and Bourdon must have been used in a vast number of secondary schools. No attempt has been made to locate these.

The following facts are given on the authority of Professor CAJORI as indicated under LEGENDRE : Besides the colleges already cited as using Bourdon, there were : Dartmouth, 1839, when BOURDON's Algebra displaced DAY's Algebra; same place, 1840, when a student reports DAVIES' Bourdon's Algebra; Cornell, sometime between 1874 and 1887, DAVIES' Bourdon; University of Virginia, 1845; of South Carolina, 1836, 1851, 1853; of Mississippi, 1854, 1866, 1872; of Transylvania, 1844; of Tennessee, 1883; of Michigan, 1849; Virginia Military Institute, no date—all DAVIES' Bourdon.

DAVIES produced an Analytical Geometry in 1836 in which

(16) *The Mathematical Diary*, loc. cit., Vol. II, p. 298f.

he states that the admirable treatise of BOURDON has been freely consulted. This treatise was : *Application de l'Algèbre à la Géométrie ouvrage adopté par l'Université*, Paris, 1828, 2d ed. The copy in the library at West Point contains notes that seem to show that this book in the original was used as a textbook.

23. JEAN BAPTISTE BIOT (1774-1862) was among those who added to the reputation of France in the field of mathematics during this period. The 18th century is characterized principally by the development of the powers of the new instruments in mathematics, particularly the calculus, in all directions and BIOT was successful in applying mathematics to problems in physics and astronomy. His writings in several branches were used by American authors. JOHN FARRAR wrote : *A Course of Natural Philosophy* in four parts, viz. *An elementary treatise on mechanics*, 1825, 1834 [Based on BIOT and other writers]; *Elements of Electricity, Magnetism and Electro-Magnetism*, 1826, 1842 [Based on BIOT's « *Précis Élémentaire de Physique* »; *An experimental treatise on optics*, 1826, [Selected from BIOT's *Précis élémentaire de physique expérimentale*]; *An elementary treatise on astronomy*, 1827, 1834 [Selected from BIOT's *Traité élémentaire d'astronomie physique*].

24. An extended use was made of BIOT's *Essai de Géométrie analytique appliquée aux Courbes et aux Surfaces du second ordre;* the first edition of which appeared in 1802. BIOT pays tribute to workers in the field before this date, by saying that « he intends to employ the general methods which LAGRANGE and MONGE were the first to make known in their works; methods taught since by MONGE at the École Polytechnique and so happily introduced by LACROIX in his elementary treatises. » This work formed the basis of one by CHARLES DAVIES which appeared in 1836 : *Elements of Analytical Geometry; embracing the equations of the point, the straight line, the conic section, and curves and surfaces of the first and the second order*, New York. Other editions are 1839, 1841, 1843, 1847, 1848, 1856, 1874.

Before the appearance of DAVIES's Analytic Geometry only two efforts had been made at an American textbook in this subject. One was a translation of BÉZOUT referred to elsewhere and another a reprint of an English author, JOHN RADFORD YOUNG : *The elements of analytical geometry*... Revised... by JOHN D. WILLIAMS...

1833. DAVIES states in his preface that : « For about sixteen years the subject of analytical geometry has made a part of the course pursued at the Military Academy, and the methods which have been adopted in the present work, are those which have been taught with the greatest success. The admirable treatises of BIOT and BOURDON have been freely consulted, and many of the examples in the seventh book have been selected from the former work. The system of BIOT has also been somewhat followed. It has been the intention to furnish a useful textbook, and no attempt has been made to depart from clear and satisfactory methods adopted by others, merely for the sake of seeming to be original. » The last sentence states his attitude in the preparation of texts, a thoroughly honest one as long as the sources are indicated.

BIOT's *Géométrie Analytique* was translated into English as : *An elementary treatise on analytical geometry : translated from the French of J. B. Biot*, for the use of the Virginia Military Institute... by FRANCIS H. SMITH, A. M. 1840, 1846, 1868. The author was at one time an assistant professor at West Point and tells us that « the original work of M. BIOT was for many years the Text Book in the... Academy... ». It is on the list from 1821-1825 and later.

25. In addition, SMITH brought in another French writer in his trigonometry : LEFÉBURE DE FOURCY. *Elements of trigonometry ; plane and spherical.* Translated from the last French edition by F. H. SMITH with tables of logarithms... Baltimore, 1868.

26. SYLVESTRE FRANÇOIS LACROIX (1765-1843) was a man of no special mathematical attainments although he held positions in the École Normale and the École Polytechnique, and the Collège de France. *An Elementary Treatise on the Differential and Integral Calculus by S. F. Lacroix. Translated from the French*, Cambridge, [England] 1816, did much to introduce the Continental methods and notation into the work of the Cambridge school of mathematicians. This translation was made by CHARLES BABBAGE, Sir JOHN FREDERICK WILLIAM HERSCHEL, and GEORGE PEACOCK. In it, LACROIX is recognized as « that distinguished author ». This work was used at West Point from 1842-(?) and later (1845) at the University of Virginia. LACROIX's Calculus was among the works used in preparing *The Differential and Integral Calculus*

[by James Ryan], 1828. The copy of it in the New York Public Library has the signature of « SAMUEL WARD, Jr. Class Col. Coll. March 22d 1830 ». It is interleaved and the blank sheets are filled with notes. It was also used freely by CHARLES DAVIES in his *Elements of the Differential and Integral Calculus*, 1836, 1839, 1843, 1846, 1855, 1873, a textbook with all of DAVIES's at West Point for many years.

27. LACROIX's Algebra was a popular one in France. It appeared here as : *Elements of Algebra by S. F. Lacroix. Translated from the French.* For the use of the students of the University at Cambridge, New England, 1818 [Preface June 1818]. This is the first work translated by an American for use in American colleges. It is usually bound with a translation of LEGENDRE and is ascribed to JOHN FARRAR. A copy of this work in the American Antiquarian Society Library has four names of the May family who used it in 1825, 1826, 1832 respectively. It went through five editions, 1818, 1825, 1831, 1833, 1837. LACROIX in the original and in the FARRAR translation appears in the West Point list. The Lacroix original was used freely by WILLIAM SMYTH whose work has been mentioned under BOURDON and by JAMES RYAN in the preparation of his *Algebra*. It was also one of the sources drawn on by DAY for his *Algebra* (1814), the first algebra by a native American. Curiously enough FARRAR had produced earlier in the year 1818 [Feb. 1818] : *An Introduction to the Elements of Algebra...* Selected from the algebra of EULER— this being the first use in America of a work translated from a foreign language.

FARRAR had also : *An elementary treatise on Plane and Spherical, Trigonometry... from the mathematics of Lacroix*, 1820, 1826, 1833, 1837; and *An Elementary Treatise on Arithmetic*, taken principally from the arithmetic of S. F. LACROIX, 1816, 1821, 1825, 1834.

28. It is unfortunate that FARRAR used for the calculus in his series a French writer of a much earlier date and one much less worthy than LACROIX. The name of ÉTIENNE BÉZOUT (1735-1796) has been perpetuated in connection with his « Method of Elimination ». A translation of BÉZOUT's Calculus came out in 1824, 1836. Similarly, FARRAR did not have the courage to use the more elaborate French treatises in analytic geometry

but devoted about two-thirds of his work on trigonometry to applications of algebra to geometry from the mathematics of BÉZOUT. The FARRAR series is an extended one. He had still another : *An Elementary Treatise on the Applications of Trigonometry to orthographic and stereographic projection...* 1822. Other editions 1828, 1833. The contents were drawn partly from this same French writer.

29. The indebtedness of arithmetic to France has received only a passing reference in this paper. The enormous impetus given to the birth and standing of the metric system is so much a matter of common knowledge that it has not even been included. It is clear that the elementary textbooks of France on which much labor and talent had been successfully expended were taken over by the outstanding writers of college texts in the first half of the 19th century. Thus was accomplished a revolution in all the branches of mathematics in this country, as well as elsewhere, to the introduction of which France justly lays claim.

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LIST OF MATHEMATICIANS AND AUTHORS OF TEXTBOOKS

Numbers refer to paragraphs

ADRAIN, ROBERT — 6, 12.
BAKER, WOODS — 16.
BÉZOUT, ETIENNE — 28.
BIOT, JEAN BAPTISTE — 23, 24.
BOURDON, LOUIS PIERRE MARIE — 17, 18, 19, 20, 21, 22, 24
BOWDITCH, NATHANIEL — 6, 7.
BREWSTER, DAVID — 11.
CARLYLE, THOMAS — 11.
CROZET, CLAUDE — 16.
DAVIES, CHARLES — 4, 13, 21, 24, 26.
FARRAR, JOHN — 10, 19, 23, 27, 28.
LACROIX, SYLVESTRE FRANÇOIS — 18, 26, 27.
LAGRANGE, JOSEPH LOUIS — 3, 4, 8, 24.
LAPLACE, PIERRE SIMON — 5, 6, 7, 8.

Lefébure de Fourcy — 25.
Legendre, Adrien Marie — 6, 8, 9, 10, 11, 12, 13, 14, 15.
Monge, Gaspard — 16, 24.
Peirce, Benjamin — 4, 7, 21.
Perkins, George — 22.
Ross, Edward C. — 20.
Ryan, James — 12, 13, 26, 27.
Smith, Francis H. — 24, 25.
Smyth, William — 18, 21, 27.
Thomson, James B. — 14.
Williams, John D. — 24

The Discovery of the Electric Cell (1800)

With facsimile reproduction (no. XI) of ALEXANDER VOLTA's *memoir « On the electricity excited by the mere contact of conducting substances of different kinds » (Philosophical Transactions of the Royal Society*, London, 1800, p. 403-31, 1 pl.)

The remarkable experiments published by LUIGI GALVANI in 1791 (*De viribus electricitatis in motu musculari)* started a new stream of thought of the utmost importance. Men of science shared for a time GALVANI's belief that a new kind of electricity « animal electricity » had been discovered, and some of them even hoped that a new method of penetrating the mysteries of life had thus been revealed. ALESSANDRO VOLTA devoted himself entirely to the study of these fascinating problems. Between 1792 and 1800 he wrote more than twenty memoirs and a number of letters on the subject. Indeed the history of it during the last decade of the eighteenth century could be almost reconstructed from his writings alone. That history can be summed up as follows. These ten years 1791-1800 witnessed the evolution from animal electricity to galvanism and from galvanism to the electric cell.

Though VOLTA was the main protagonist, he was not by any means the only one. In fact a complete history of these ten fateful years would be very complicated, and I shall not attempt to tell it or even to outline it in this preface. It will suffice to recall some of the main events and the main personalities.

As early as 1792, the editor of the *Journal der Physik*, FRIEDRICH ALBRECHT CARL GREN (1760-98), professor in Halle, published in his own journal a paper of which the very title was significative, *Bemerkungen über die sogenannte thierische Electrizität* (note the word *sogenannte*). His scepticism was shared by some of his colleagues, notably by the physician, JOHANN CHRISTIAN REIL (1758-1813), and by the versatile Hofrat LICHTENBERG. « Wie

wäre es, meynte mein Freund REIL, wenn alle die von Hrn. GALVANI und VALLI beobachteten Erscheinungen Wirkungen der schon längst bekannten Reitzbarkeit der Muskeln und der bekannten Reitzung der elektrischen Materie auf sie wären? Bedürfte es da wohl einer eigenen *thierischen Electrizität* um sie zu erklären? » See notes by GREN, REIL and LICHTENBERG in *Journal der Physik* (vol. 6, 402-15, 1792; my quotation on p. 409).

In September 1792, VOLTA was still believing in the reality of animal electricity, witness his letter of Sept. 13 to TIBERIUS CAVALLO, (1) but by the following May, he had already been obliged to change his mind. In his private letter of May 22 to the same CAVALLO he wrote : (2)

« Such is the Theory of this new principle of Electricity, for which, however, the name of Animal Electricity is by no means proper, in the sense intended by GALVANI, and by others; namely, that the Electric fluid becomes unbalanced in the animal organs, and by their own proper force, by some particular action of the vital powers. No, this is a mere artificial Electricity, induced by an external cause, that is, excited originally in a manner hitherto unknown, by the connexion of Metals with any kind of wet substance. And the animal organs, the nerves and the muscles, are merely passive, though easily thrown into action whenever, by being in the circuit of the Electric current, produced in the manner already mentioned, they are attacked and stimulated by it, particularly the nerves. »

In the meanwhile English physicists were also investigating the subject. An interesting document is preserved by F. ALEXANDER VON HUMBOLDT in his *Versuche über die gereizte Muskel- und Nervenfaser* (vol. 1, Posen, 1797, 472). Dr. ASH of Oxford (3) had written to him in April 1796, that he was concentrating his attention upon the metals, and trying to discover the changes taking place when similar or dissimilar metals were brought into contact. From the experiments he had made it seemed probable that the greatest galvanic activity was associated with the greatest chemical change. For example when moistened zinc and silver

(1) *Philos. Trans.*, 1793; *Le Opere di* A. VOLTA (vol. 1, 1918, 173-83, see notably § 12, p. 178).

(2) *Opere* (vol. 1, 204.)

(3) This was the physician and chemist JOHN ASH (1723-98).

plates were brought into contact, the zinc seemed to be oxydised and the silver was covered with a fine white dust. ALEXANDER VON HUMBOLDT at once appreciated the significance of ASH's experiments, and of others of the same kind. He repeated them and observed the decomposition of water and the release of gas bubbles.

Finally that unlucky man of genius, JOHANN WILHELM RITTER (1776-1810) generalized these observations in his *Einige Beobachtungen über den Galvanismus in der anorganischen Natur und über den Zusammenhang der Electricität mit der chemischen Qualität der Körper* (*Annalen der Physik*, vol. 2, 80-86, Halle, 1799).

To return to VOLTA, he had steadily continued his experiments and his intellectual evolution from animal electricity to galvanism. That evolution may be followed step by step in his letters to ANTON MARIA VASSALLI (1794, 1795), to ORAZIO DELFICO and FRANCESCO MOCCHETTI (1795), to GREN of Halle (1796, 1797) — in his third letter to GREN (4) the phrase elettricità animale is finally replaced by elettricità metallica — to the Dutch physicist VAN MARUM (1797), to ALDINI (1798), and it culminates in the famous letter to Sir JOSEPH BANKS of which we reproduce a facsimile.

The letter to BANKS contains a detailed description of a new instrument or rather of two forms of it, the « crown of cups » and the « Voltaic pile ». These were the earliest electric cells. The world was given a means of producing for the first time a steady electric current. In contrast with the chemical tendencies of JOHN ASH, v. HUMBOLDT, and RITTER, VOLTA gave a purely electrical theory of his pile, the « contact theory ». He did not pay attention to the chemical changes, and thus his instrument seemed to realize a sort of perpetuum mobile (p. 421). He compared it to an « artificial electric organ » (p. 405), as opposed to the natural electric organ of certain fishes. With this obvious exception, all ideas of animal magnetism were abandoned by him. On the contrary, he suggested an explanation of the electric organ of the Torpedo by an analogy with his own cells (p. 416, 430).

VOLTA's fundamental paper dated March 20, 1800, was read at the Royal Society only on June 26, but Sir JOSEPH BANKS had communicated it in April to ANTHONY CARLISLE, and thus some

(4) *Opere* (vol. 1, 447).

English physicists were able to avail themselves of the precious knowledge which it contained, before its publication. This is reported by WILLIAM NICHOLSON in his *Journal of natural philosophy* (vol. 4, July, 1800, 179-187). However NICHOLSON and CARLISLE forbore publishing their results before VOLTA, and besides their efforts were soon directed toward the chemical applications; they were DAVY's forerunners, — and that is another story.

The discovery of the electric cell was received with an enthusiasm which is surprizing if one considers that no one was then able to grasp its almost unlimited possibilities. But even the little that could be imagined at once was sufficient to make the more thoughtful people realize that mankind had been enriched with a new instrument of untold power. One might compare this discovery with that of the telescope and microscope two centuries earlier, with this essential difference however, that after all these older instruments were only means of magnifying our vision. They enabled us to see things which we could not see before, but which existed nevertheless. The telescope did not create stars, nor the microscope, infusoria, except in man's consciousness. On the contrary, the electric cell was really a creative instrument; it opened to man a new and incomparable source of energy.

The most striking reception of VOLTA's achievement occurred in Paris. At the memorable meeting of the Académie des sciences of the 16 Brumaire an X (Nov. 7, 1801), VOLTA explained his discovery, and one of the members, the citoyen BONAPARTE, was heard to observe to his colleague FOURCROY « These phænomena belong to chemistry even more than to physics, and you ought to get hold of them ». NAPOLEON's admiration for VOLTA increased as the years went by, and he showered many honors upon him. It is said, one day as he was passing in the library of the Institut before a laurel crown dedicated « to the great VOLTAIRE », he erased the last three letters making it read « to the great VOLTA ». This anecdote may be apocryphal, but it is not unplausible. It would be tempting to make a comparison between these two great personalities, VOLTAIRE and VOLTA, and to try to measure their respective contributions, but I shall leave that pleasure to the reader.

ALESSANDRO VOLTA was born in Como, in 1745, and was professor of physics in the gymnasium of his native town and later at the university of Pavia; he received the Copley medal in 1794; in 1819, he retired to his beloved Como and died there on March 5, 1827. His death occurred on the very same day as LAPLACE's, and almost exactly a century later than NEWTON's. (5)

November 2, 1929. GEORGE SARTON.

P. S. — For the photostat used for this facsimile edition, I am indebted to the courtesy of the Library of Congress and of Mr. F. E. BRASCH.

Text

A national edition of VOLTA's works is in course of publication. Le opere di ALESSANDRO VOLTA (Milano, HOEPLI). Vol. 1, published in 1918 (XXVIII+592 p., 8 pl.) contains all the papers and letters, some hitherto unpublished, on animal magnetism and related questions leading to the famous memoir of 1800. A selection of his works was edited by FRANCESCO MASSARDI (lxviii+580 p., 26 pl., Milano, 1927; *Isis*, 11, 463). Lettere inedite (Pesaro, 1834).

Biography

Biographical notes are included in MASSARDI's anthology. On the occasion of VOLTA's centenary in 1927, a great number of articles and books were devoted to him, many of which will be found in the critical bibliography of *Isis* (vol. 11, ff.) in the section devoted to the second half of the eighteenth century (B). There does not seem to be any standard biography.

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(5) NEWTON died on March 20, 1727.

XVII. *On the Electricity excited by the mere Contact of conducting Substances of different kinds. In a Letter from Mr.* Alexander Volta, *F. R. S. Professor of Natural Philosophy in the University of Pavia, to the Rt. Hon. Sir* Joseph Banks, *Bart. K. B. P. R. S.*

Read June 26, 1800.

A Côme en Milanois, ce 20me Mars, 1800.

Après un long silence, dont je ne chercherai pas à m'excuser, j'ai le plaisir de vous communiquer, Monsieur, et par votre moyen à la Société Royale, quelques resultats frappants auxquels je suis arrivé, en poursuivant mes expériences sur l'électricité excitée par le simple contact mutuel des métaux de différente espèce, et même par celui des autres conducteurs, aussi différents entr'eux, soit liquides, soit contenant quelque humeur, à laquelle ils doivent proprement leur pouvoir conducteur Le principal de ces resultats, et qui comprend à-peu-près tous les autres, est la construction d'un appareil qui ressemble pour les effets, c'est-à-dire, pour les commotions qu'il est capable de faire éprouver dans les bras, &c. aux bouteilles de Leyde, et mieux encore aux batteries électriques foiblement chargées, qui agiroient cependant sans cesse, ou dont la charge, après chaque explosion, se rétabliroit d'elle-même; qui jouiroit, en un mot, d'une charge indéfectible, d'une action sur le fluide électrique, ou impulsion, perpétuelle; mais qui d'ailleurs en diffère essentiellement, et

par cette action continuelle qui lui est propre, et parcequ'au lieu de consister, commes les bouteilles et batteries électriques ordinaires, en une ou plusieurs lames isolantes, en couches minces de ces corps censés être les seuls *électriques*, armées de conducteurs ou corps ainsi dit *non-électriques*, ce nouvel appareil est formé uniquement de plusieurs de ces derniers corps, choisis même entre les meilleurs conducteurs, et par là les plus éloignés, suivant ce qu'on a toûjours cru, de la nature électrique. Oui, l'appareil dont je vous parle, et qui vous étonnera sans doute, n'est que l'assemblage d'un nombre de bons conducteurs de différente espèce, arrangés d'une certaine manière. 30, 40, 60 pièces, ou d'avantage, de cuivre, ou mieux d'argent, appliquées chacune à une pièce d'étain, ou, ce qui est beaucoup mieux, de zinc, et un nombre égal de couches d'eau, ou de quelque autre humeur qui soit meilleur conducteur que l'eau simple, comme l'eau salée, la lessive, &c. ou des morceaux de carton, de peau, &c. bien imbibés de ces humeurs; de telles couches interposées à chaque couple ou combinaison des deux métaux différents, une telle suite alternative, et toûjours dans le même ordre, de ces trois espèces de conducteurs, voilà tout ce qui constitue mon nouvel instrument; qui imite, comme j'ai dit, les effets des bouteilles de Leyde, ou des batteries électriques, en donnant les mêmes commotions que celles-ci; qui, à la vérité, reste beaucoup au-dessous de l'activité des dites batteries chargées à un haut point, quant à la force et au bruit des explosions, à l'étincelle, à la distance à laquelle peut s'opérer la décharge, &c. egalant seulement les effets d'une batterie chargée à un degré très-foible, d'une batterie pourtant ayant une capacité immense; mais qui d'ailleurs surpasse infiniment la vertu et le pouvoir de ces mêmes batteries, en ce qu'il n'a pas besoin, comme elles,

d'être chargé d'avance, au moyen d'une électricité étrangère; et en ce qu'il est capable de donner la commotion, toutes les fois qu'on le touche convenablement, quelques fréquents que soient ces attouchements.

Cet appareil, semblable dans le fond, comme je ferai voir, et même tel que je viens de le construire, pour la forme, à l'*organe électrique naturel* de la torpille, de l'anguille tremblante, &c. bien plus qu'à la bouteille de Leyde, et aux batteries électriques connues, je voudrois l'appeller *Organe électrique artificiel*. Et au vrai n'est-il pas, comme celui-là, composé uniquement de corps conducteurs ? n'est-il pas au surplus actif par lui-même, sans aucune charge précédente, sans le sécours d'une électricité quelconque excitée par aucun des moyens connus jusqu'ici ; agissant sans cesse, et sans relâche; capable enfin de donner à tout moment des commotions plus ou moins fortes, selon les circonstances, des commotions qui redoublent à chaque attouchement, et qui, repétées ainsi avec fréquence, ou continuées pour un certain tems, produisent ce même engourdissement des membres que fait éprouver la torpille, &c. ?

Je vais vous donner ici une description plus détaillée de cet appareil, et de quelques autres analogues, aussi bien que des expériences relatives les plus remarquables.

Je me fournis de quelques douzaines de petites plaques rondes ou disques, de cuivre, de laiton, ou mieux d'argent, d'un pouce de diamétre, plus ou moins, (par exemple, de monnoyes,) et d'un nombre égal de plaques d'étain, ou, ce qui est beaucoup mieux, de zinc, de la même figure et grandeur, à-peu-près ; je dis à-peu-près, parcequ'une précision n'est point requise, et, en général, la grandeur, aussi bien que la figure, des pièces métalliques, est arbitraire : on doit avoir égard seulement qu'on puisse les

arranger commodément les unes sur les autres, en forme de colonne. Je prépare en outre, un nombre assez grand de roulles de carton, de peau, ou de quelque autre matière spongieuse, capable d'imbiber et de retenir beaucoup de l'eau, ou de l'humeur dont il faudra, pour le succès des expériences, qu'elles soient bien trempées. Ces tranches ou rouelles, que j'appellerai disques mouillés, je les fais un peu plus petites que les disques ou plateaux métalliques, afin qu'interposées à ceux, de la manière que je dirai tantôt, ils n'en débordent pas.

Ayant sous ma main toutes ces pièces, en bon état, c'est-à-dire, les disques métalliques bien propres et secs, et les autres non-métalliques bien imbibés d'eau simple, ou, ce qui est beaucoup mieux, d'eau salée, et essuyés ensuite légèrement, pour que l'humeur n'en dégoutte pas, je n'ai plus qu'à les arranger comme il convient ; et cet arrangement est simple et facile.

Je pose donc horizontalement sur une table ou base quelconque, un des plateaux métalliques, par exemple, un d'argent, et sur ce premier j'en adapte un second de zinc ; sur ce second je couche un des disques mouillés ; puis un autre plateau d'argent, suivi immédiatement d'un autre de zinc, auquel je fais succéder encore un disque mouillé. Je continue ainsi, de la même façon, accouplant un plateau d'argent avec un de zinc, et toûjours dans le même sens, c'est-à-dire, toûjours l'argent dessous et le zinc dessus, ou *vice versâ*, selon que j'ai commencé, et interposant à chacun de ces couples, un disque mouillé ; je continue, dis-je, à former, de plusieurs de ces étages, une colonne aussi haute qu'elle peut se soutenir sans s'écrouler.

Or, si elle parvient à contenir environ 20 de ces étages ou couples de métaux, elle sera déjà capable, non seulement de faire donner des signes à l'électrometre de CAVALLO, aidé du

condensateur, au-delà de 10 ou 15 dégrés, de charger ce condensateur par un simple attouchement, au point de lui faire donner une étincelle, &c. mais aussi de frapper les doigts avec lesquels on vient toucher ses deux extremités, (la tête et le pied d'une telle colonne,) d'un ou de plusieurs petits coups, et plus ou moins fréquents, selon qu'on réitère ces contacts; chacun desquels coups ressemble parfaitement à cette légère commotion que fait éprouver une bouteille de Leyde foiblement chargée, ou une batterie chargée beaucoup plus foiblement encore, ou enfin une torpille extrêmement languissante, qui imite encore mieux les effets de mon appareil, par la suite des coups répétés qu'elle peut donner sans cesse.

Pour obtenir de telles légères commotions de cet appareil que je viens de décrire, et qui est encore trop petit pour de grands effets, il est nécessaire que les doigts avec lesquels on veut toucher ses deux extremités en même tems, soient humectés d'eau, au point que la peau, qui autrement n'est pas un assez bon conducteur, se trouve bien trempée. Encore, pour réussir plus sûrement, et recevoir des commotions considérablement plus fortes, faut-il faire communiquer, par le moyen d'une lame suffisamment large, ou d'un gros fil métallique, le pied de la colonne, c'est-à-dire, le plateau du fond, avec l'eau d'un bassin ou coupe assez grande, dans laquelle on tiendra plongé un doigt, deux, trois, ou toute la main, tandis qu'on ira toucher la tête ou extrémité supérieure, (le dernier ou un des derniers plateaux de cette colonne,) avec l'extrémité nette d'une lame aussi métallique, empoignée par l'autre main, qui doit être bien humide, et embrasser une large surface de cette lame, et la serrer fortement. En procédant de cette manière, je puis déjà obtenir un petit picotement, ou légère commotion, dans une ou deux

articulations d'un doigt plongé dans l'eau du bassin, en touchant, avec la lame empoignée dans l'autre main, la quatrième, ou même la troisième paire de plateaux ; touchant ensuite la cinquième, la sixième, et de proche en proche les autres, jusqu' au dernier plateau, qui fait la tête de la colonne, il est curieux d'éprouver comment les commotions augmentent graduellement en force. Or, cette force est telle, que je parviens à recevoir d'une telle colonne, formée de 20 paires de plateaux, (pas davantage,) des commotions qui prennent tout le doigt, et l'affectent même assez douloureusement, s'il est plongé seul dans l'eau du bassin ; qui s'étendent (sans douleur) jusqu'au poignet, et même jusqu' au coude, si la main est plongée en grande partie, ou entièrement, et se font sentir encore au poignet de l'autre main.

Je suppose toûjours qu'on ait pratiqué toutes les attentions nécessaires dans la construction de la colonne, que chacune des paires ou couples de métaux, resultant d'une plaque d'argent appliquée à une de zinc, se trouve en communication avec la couple suivante, par une couche suffisante d'humeur, qui soit de l'eau salée, plutôt que de l'eau pure, ou par un disque de carton, de peau, ou autre chose semblable, bien imbibée de cette eau salée ; lequel disque ne soit pas trop petit, et dont les surfaces soient bien collées aux surfaces des plateaux métalliques, entre lesquels il se trouve interposé. Cette application exacte et étendue des disques mouillés, est très-importante ; au lieu que les plateaux métalliques de chaque paire, peuvent ne se toucher entr'eux qu'en peu de points, pourvu seulement que leur contact soit immédiat.

Tout cela fait voir (pour le dire ici en passant) que si le contact des métaux entr'eux en quelques points seulement suffit (étant tous d'excellents conducteurs) pour donner libre passage à un courant électrique médiocrement fort, il n'en est pas de

même pour les liquides, ou pour les corps imbibés d'humeur, qui sont des conducteurs beaucoup moins parfaits, et qui, par conséquent, ont besoin d'un ample contact avec les conducteurs métalliques, et plus encore entr'eux, pour que le fluide électrique puisse passer avec assez de facilité, et pour qu'il ne soit pas trop retardé dans son cours, sur-tout lorsqu'il est mu avec très-peu de force, comme dans notre cas.

Au reste, les effets de mon appareil (les commotions qu'on éprouve) sont considérablement plus sensibles, à mesure que la température de l'air ambient, ou celle de l'eau, ou des disques mouillés qui entrent dans la composition de la colonne, et de l'eau même du bassin, est plus chaude; la chaleur rendant l'eau plus conductrice. Mais, ce qui la rend beaucoup meilleure encore, ce sont presque tous les sels, et notamment le sel commun. Voilà une des raisons, sinon la seule, pourquoi il est si avantageux que l'eau du bassin, et sur-tout celle interposée à chaque paire de plateaux métalliques, l'eau dont sont imbibés les disques de carton, &c. soit de l'eau salée, comme j'ai déjà fait remarquer.

Mais tous ces moyens, et toutes ces attentions, enfin, n'ont qu'un avantage limité, et ne feront jamais qu'on puisse obtenir des commotions bien fortes, tant que l'appareil ne consistera qu'en une seule colonne formée de 20 paires seulement de plateaux, quoiqu'ils soient des deux meilleurs métaux pour ces expériences, sçavoir, d'argent et de zinc; car, s'ils étoient d'argent et de plomb, ou d'étain, ou de cuivre et d'étain, on n'obtiendroit pas la moitié de l'effet, à moins qu'un nombre beaucoup plus grand ne suppléât à la moindre force de chaque paire. Or donc, ce qui augmente réellement la puissance électrique de cet appareil, et la peut porter au degré d'égaler, et de surpasser encore, celle de la torpille et de l'anguille tremblante, c'est le

nombre des plateaux, arrangés de la manière, et avec les attentions, que j'ai expliqué. Si, aux 20 paires décrites ci-dessus, on en ajoute 20 ou 30 autres, disposées dans le même ordre, les commotions que pourra donner la colonne ainsi prolongée, (je dirai tantôt comment on peut la soutenir, pour qu'elle ne s'écroule pas, ou, ce qui est mieux, la partager en deux ou plusieurs colonnes,) seront déjà beaucoup plus fortes, et s'étendront dans les deux bras jusqu'à l'épaule, sur-tout dans celui dont la main est plongée dans l'eau; laquelle main, avec le bras entier, en restera plus ou moins engourdie, si, en réitérant les attouchements avec fréquence, on fait succéder ces commotions l'une à l'autre rapidement, et sans relâche. Cela, en plongeant toute, ou presque toute, la main dans l'eau du bassin; mais, si on ne plonge qu'un doigt seul, en tout ou en partie, les commotions concentrées presque dans lui seul, en seront d'autant plus douloureuses, et si cuisantes qu'elles deviendront insupportables.

On s'attend bien que cette colonne, formée de 40 ou 50 couples de métaux, qui donne des commotions plus que médiocres aux deux bras d'une personne, pourra en donner encore de sensibles à plusieurs, qui, se tenant par leurs mains, (suffisamment humides,) forment une chaine non interrompue.

Revenant à la construction mecanique de mon appareil, qui est susceptible de plusieurs variations, je vais décrire ici, non pas toutes celles que j'ai imaginées et exécutées, soit en grand, soit en petit, mais quelques unes seulement, qui sont ou plus curieuses, ou plus utiles; qui présentent quelqu' avantage réel, comme d'être d'une exécution plus facile, ou plus expéditive, d'être plus immanquables dans leurs effets, ou plus long-tems conservables en bon état.

Et pour commencer par une, qui, réunissant à-peu-près tous

ces avantages, diffère le plus, quant à sa figure, de *l'appareil à colonne* décrit ci-dessus, mais qui a le desavantage d'être une machine beaucoup plus volumineuse ; je vous présente ce nouvel appareil, que j'appellerai *à couronne de tasses*, dans la figure ci-jointe. (Pl. XVII. Fig. 1.)

On dispose donc une rangée de plusieurs tasses ou coupes, de quelque matière que ce soit, exceptés les métaux, de tasses de bois, d'ecaille, de terre, ou mieux de cristal, (des petits verres à boire ou gobelets, sont les plus à-propos,) à demi pleines d'eau pure, ou mieux d'eau salée, ou de lessive ; et on les fait communiquer toutes, on en forme une espèce de chaine, par le moyen d'autant d'arcs metalliques, dont un bras A *a*, ou seulement l'extrémité A, qui plonge dans un des gobelets, est de cuivre rouge, ou jaune, ou mieux de cuivre argenté, et l'autre *Z*, qui plonge dans le gobelet suivant, est d'étain, ou mieux de zinc. J'observerai ici, en passant, que la lessive et les autres liqueurs alcalines sont préférables, lorsqu' un des métaux qui doivent plonger, est l'étain ; l'eau salée est préférable, lorsque c'est le zinc. Les deux métaux dont chaque arc se compose, sont soudés ensemble, dans quelque endroit que ce soit, au-dessus de la partie qui plonge dans le liquide, et qui doit le toucher par une surface suffisamment large : il est pour cela convenable, que cette partie soit une lame d'un pouce quarré, ou très-peu moins ; le reste de l'arc peut être plus étroit tant qu'on veut, et même un simple fil métallique. Il peut aussi être d'un troisième métal, différent des deux qui plongent dans le liquide des gobelets ; puisque l'action sur le fluide électrique, qui résulte de tous les contacts de plusieurs métaux qui se succédent immédiatement, la force avec laquelle ce fluide se trouve poussé à la fin, est la même absolument, ou à-peu-près, que celle qu'il auroit

reçu par le contact immediat du premier métal avec le dernier, sans aucun des métaux intermédiaires, comme j'ai verifié par des expériences directes, dont j'aurai occasion de parler ailleurs.

Or donc, une suite de 30, 40, 60, de ces gobelets, enchainés de cette manière, et rangés, soit dans une ligne droite, soit dans une courbe, ou repliée de toutes les manières, forme tout ce nouvel appareil; qui dans le fond, et en substance, est le méme que l'autre à colonne, décrit plus haut; l'essentiel, qui consiste dans la communication immediate des métaux différents qui forment chaque couple, et médiate d'une couple avec l'autre, savoir, par l'interméde d'un conducteur humide, ayant lieu pour l'un, aussi bien que pour l'autre de ces appareils.

Quant à la manière de mettre celui à gobelets à l'épreuve, et quant aux différentes expériences auxquelles il peut servir, je n'ai pas besoin d'en dire beaucoup, après ce que j'ai fait observer, et expliqué amplement, au sujet de l'autre à colonne. On comprendra aisément, que pour avoir la commotion, il suffit de plonger une main dans un des gobelets, et un doigt de l'autre main dans un autre gobelet, assez eloigné de celui-la; que cette commotion sera d'autant plus forte que ces deux vases seront plus éloignés l'un de l'autre, c'est-à-dire, qu'il y en aura un plus grand nombre d'intermédiaires; que, par conséquent, on aura la plus forte, en touchant le premier et le dernier de la chaine. On comprendra aussi comment, et pourquoi, les expériences réussiront beaucoup mieux, en empoignant, et serrant, dans une main bien humectée, une lame métallique assez large, (afin que la communication soit ici assez parfaite, et se fasse par un grand nombre de points,) et touchant avec cette lame l'eau du gobelet, ou plutôt l'arc métallique designé, tandis que l'autre main se trouve plongée dans l'autre gobelet éloigné, ou touche,

avec une lame empoignée de même, l'arc de celui-ci. Enfin on comprendra, et on pourra même prévoir le succès d'une grande variété d'expériences, qu'on peut exécuter avec cet *appareil à couronne de tasses*, plus facilement, et d'une manière plus evidente et parlante, pour ainsi dire, aux yeux, qu'avec l'autre appareil à colonne. Je me dispenserai donc de décrire un grand nombre de ces expériences faciles à deviner, et j'en rapporterai seulement quelques unes, qui ne sont pas moins instructives qu'amusantes.

Soient trois vingtaines de ces tasses ou gobelets, rangés et enchainés l'un à l'autre par les arcs métalliques, mais de façon que, pour la première vingtaine, ces arcs soient tournés dans le même sens, par exemple, le bras d'argent tourné à gauche, et le bras de zinc à droite; et pour la seconde vingtaine, en sens contraire, c'est-a-dire, le zinc à gauche, et l'argent à droite; enfin, pour la troisième vingtaine, de nouveau, l'argent à gauche, comme pour la première. Ces choses ainsi disposées, plongez un doigt dans l'eau du premier gobelet, et touchez, avec la lame empoignée par l'autre main, de la manière préscrite, le premier arc métallique, (celui qui joint le premier gobelet au second,) puis l'autre arc qui embrasse le second et le troisième gobelet, et successivement les autres arcs, jusqu'à les parcourir tous. Si l'eau est bien salée et tiéde, et la peau des mains assez humectée et ramollie, vous commencerez déjà à éprouver une petite commotion dans le doigt, lorsque vous serez parvenu à toucher le 4e ou le 5e arc; (je l'ai éprouvée quelquefois assez distinctement par le contact du 3e;) et, en passant successivement au 6e, 7e, &c, les secousses augmenteront graduellement de force, jusqu'au 20e arc, c'est-à-dire, jusqu'au dernier de ceux tournés dans le même sens: mais, en passant outre, au 21e, 22e, 23e, ou 1er, 2d, 3e,

de la seconde vingtaine, dans laquelle ils sont tous tournés en sens contraire, les secousses deviendront à chaque pas moins fortes, si bien, qu'au 36e, ou 37e, elles seront imperceptibles, et absolument nulles au 40e; passé lequel, (et commençant la troisième vingtaine, opposée à la seconde, et analogue à la première,) les secousses seront encore imperceptibles, jusqu'au 44e ou 45e arc; mais elles recommenceront à dévenir sensibles, et à augmenter graduellement, à mesure que vous avancerez, jusqu'au 60e, où elles seront arrivées à la même force du 20e arc.

Or, si les 20 arcs du milieu étoient tournés dans le même sens que les 20 précedents et les 20 suivants, si tous les 60 conspiroient à pousser le fluide électrique dans la même direction, on comprend de combien l'effet seroit plus grand à la fin, et la commotion plus forte; et en général on comprend comment, et jusqu'à quel point, elle doit être affoiblie, dans tous les cas ou un nombre plus ou moins grand de ces forces, par la position des métaux à l'opposite, se contrarient.

Si la chaine est interrompue quelque part, soit que l'eau manque dans une des tasses, soit qu'un des arcs métalliques ait été enlevé, ou qu'il soit séparé en deux pieces, vous n'aurez aucune commotion en plongeant un doigt dans l'eau du premier, et un autre dans l'eau du dernier vase; mais vous l'aurez, forte ou foible, selon les circonstances, (laissant ces doigts plongés,) au moment qu'on rétablira la communication rompue, au moment qu'une autre personne plongera dans les deux tasses où manque l'arc, deux de ses doigts, (qui seront aussi frappés d'une légère commotion,) ou mieux, qu'elle y plongera ce même arc qu'on avoit ôté, ou un autre quelconque; et, dans le cas de l'arc separé en deux piéces, au moment qu'on ramenera celles-ci au contact mutuel; (de laquelle manière la commotion sera

plus forte qu'autrement;) enfin, dans le cas de la tasse vuide, au moment qu'en y versant de l'eau, elle abordera aux deux bras métalliques enfoncés dans cette tasse, et qui se trouvoient à sec.

Lorsque la chaine ou couronne de tasses est assez longue, et en état de pouvoir donner une forte commotion, on l'éprouvera, quoique beaucoup plus foible, quand même on tiendroit plongés les deux doigts, ou les deux mains, dans un seul bassin d'eau assez grand, dans lequel aboutissent le premier et le dernier arc métallique, pourvu que l'une ou l'autre de ces mains enfoncées, ou mieux toutes les deux, on les tienne respectivement en contact de ces mêmes arcs, ou assez près du contact; on éprouvera, dis-je, une commotion, au moment que (la chaine se trouvant interrompue quelque part) la communication sera rétablie, et le cercle completé, d'une des manières qu'on vient de dire. Or, on pourroit être surpris, que dans ce cercle, le courant électrique, ayant son passage libre à travers une masse d'eau non interrompue, dans cette eau qui remplit le bassin, quitte ce bon conducteur, pour se jetter, et poursuivre son cours, à travers le corps de la personne qui tient ses mains plongées dans cette même eau, en faisant ainsi un plus long trajet. Mais la surprise cessera, si on reflechit, que les substances animales vivantes et chaudes, et sur-tout leurs humeurs, sont en général des meilleurs conducteurs que l'eau. Le corps donc de la personne qui plonge les mains dans l'eau, offrant un passage plus facile que cette eau au torrent électrique, celui-ci doit le préférer, quoiqu'un peu plus long. Au reste, comme le fluide électrique, lorsqu'il doit traverser en quantité, des conducteurs qui ne sont pas parfaits, et nommément des conducteurs humides, aime à s'étendre dans un canal plus large, ou à se partager en plusieurs,

et à prendre même des détours, trouvant en cela moins de résistance qu'à suivre un seul canal, quoique plus court; ce n'est dans notre cas qu'une partie du torrent électrique, qui, s'ecartant de l'eau, prend cette nouvelle route de la personne, et la parcourt d'un bras à l'autre: une autre partie, plus ou moins grande, passe à travers l'eau du bassin. Voilà la raison pourquoi la secousse qu'on éprouve, est beaucoup plus foible que lorsque le courant électrique n'est point partagé, lorsque la personne fait seule la communication d'un arc à l'autre, &c.

D'après ces expériences, on peut croire, que lorsque la torpille veut donner une secousse aux bras de l'homme, ou aux animaux qui la touchent, ou qui s'approchent de son corps sous l'eau, (laquelle secousse est pareillement beaucoup plus foible que celle que le poisson peut donner hors de l'eau,) elle n'a qu'à rapprocher quelques unes des parties de son organe électrique, là où, par quelque intervalle, la communication manque; qu'à ôter ces interruptions entre l'une et l'autre des colonnes dont est formé le dit organe, ou entre ces membranes, en forme de disques minces, qui gissent les unes sur les autres, du fond jusqu'au sommet de chaque colonne: elle n'a, dis-je, qu'à ôter ces interruptions dans un ou plusieurs endroits, et y faire naître le contact convenable, soit en comprimant ces mêmes colonnes, soit en faisant couler entre les pellicules ou diaphragmes soulévés, quelqu'humeur, &c. Voilà quelle peut être, et, comme j'imagine, quelle est réellement, toute la tâche de la torpille, en donnant la commotion; car tout le reste, je veux dire l'incitation et mouvement donné au fluide électrique, n'est qu'un effet nécessaire de son organe singulier, formé, comme on voit, d'une suite très-nombreuse de conducteurs, que j'ai tout le fondement de croire assez différents entr'eux pour être aussi

moteurs du fluide électrique, dans leurs contacts mutuels, et de les supposer arrangés de la manière convenable pour pousser ce fluide avec une force suffisante, de haut en bas, ou de bas en haut, et determiner un courant capable de produire la commotion, &c. sitôt, et chaque fois, que tous les contacts et communications nécessaires ont lieu.

Mais laissons maintenant la torpille, et son *organe électrique naturel*, et revenons à l'*organe électrique artificiel* de mon invention, et particulièrement à celui qui imite le premier, même par la forme, (car celui à gobelets s'en éloigne à cet égard,) revenons à mon premier *appareil a colonne*. J'aurois quelque chose encore à dire par rapport à la construction du dit appareil à gobelets ou *à couronne de tasses*, par exemple, qu'il est bon que la première et la dernière tasse soient assez grandes pour pouvoir y plonger, à l'occasion, toute la main, &c.; mais il seroit trop long d'entrer dans tous ces détails.

Quant à l'appareil à colonne, j'ai cherché les moyens de l'allonger beaucoup, en multipliant les plateaux métalliques sans qu'elle s'écroulât; de rendre cet instrument commode et portatif, et, sur-tout, durable; et j'ai trouvé, entr'autres, les suivants, que je vous mets sous les yeux, par les figures ci-jointes. (Pl XVII. Fig. 2, 3, 4.)

Dans la Fig. 2de, *m m m m*, sont des montants ou baguettes, au nombre, de trois, quatre, ou plus, qui s'élèvent du pied de la colonne, et renferment, comme dans un cage, les plateaux ou disques posés les uns sur les autres, en tel nombre, et jusqu'à la hauteur qu'on veut, et les empêchent ainsi de tomber. Les baguettes peuvent être de verre, de bois, ou de métal; seulement, dans ce dernier cas, il faut empêcher qu'elles touchent immédiatement les plateaux; ce qu'on peut faire, ou en couvrant

chacune de ces baguettes métalliques avec un tube de verre, ou en interposant entre celles-ci et la colonne, quelques bandes de toile cirée, de papier huilé, ou même de papier simple, ou tout autre corps enfin, qui soit ou *cobibent*, ou mauvais conducteur : le bois, ou le papier, le sont assez pour notre cas, pourvu seulement qu'ils ne soient pas extrémement humides, ou mouillés.

Mais le meilleur expédient, lorsqu'on veut former l'appareil d'un nombre très-grand de plateaux, au-delà, par exemple, de 60, 80, 100, est de partager la colonne en deux ou plusieurs, comme on voit dans les Figures 3 et 4; (Pl. XVII.) où les pièces ont toutes leurs positions et communications respectives, comme si c'étoit une seule colonne. On peut en effet regarder la Fig. 4e, aussi bien que la 3e, comme une colonne repliée.

Dans toutes ces figures, les plateaux métalliques différents sont designés par les lettres A et Z; (qui sont les initielles d'*argent* et de *zinc;)* et les *disques mouillés* (de carton, de peau, &c.) interposés à chaque couple de ces métaux, par une couche noire. Les lignes ponctuées marquent l'union d'un métal avec l'autre, dans chaque couple, leur contact mutuel par un nombre quelconque de points; ce qui est indifférent, ou qu'ils sont soudés ensemble, ce qui est bien à plus d'un égard. *c c*, *c c*, *c c*, sont des plaques métalliques, qui font communiquer une colonne, ou section de colonne, à l'autre; et *b*, *b*, *b*, *b*, *b*, sont, les bassins d'eaux, en communication avec les pieds ou extrémités des colonnes.

Un appareil ainsi monté est assez commode, pas volumineux, et on pourroit le rendre encore plus facilement et plus sûrement portatif, à l'aide de quelques étuis ou canons, dans lesquels on enfermeroit et garderoit chaque colonne. C'est dommage seulement qu'il ne dure pas long-tems en bon état; les disques

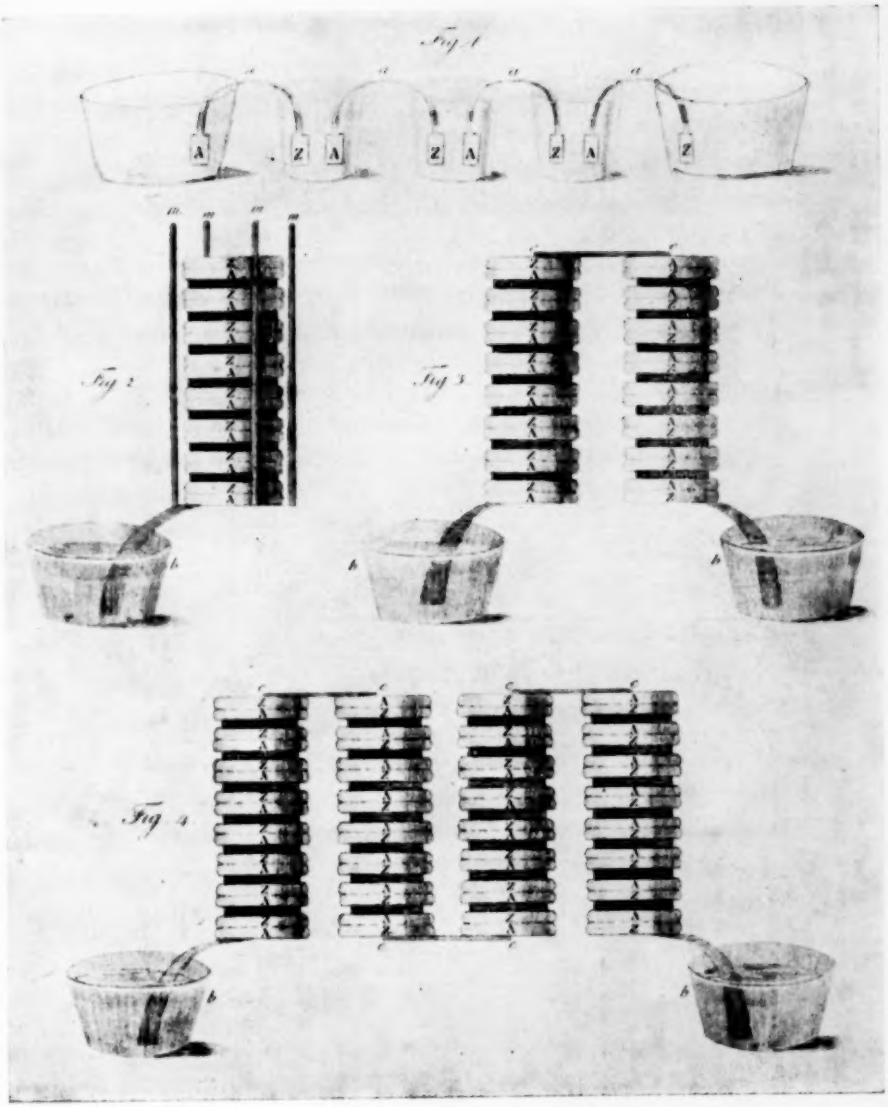


Fig 1
A
Z
Fig 2
Fig 3
Fig 4
b

mouillés se desséchant, dans un ou deux jours, au point qu'il faut les humecter de nouveau; ce qu'on peut faire pourtant, sans démonter tout l'appareil, en plongeant les colonnes toutes faites dans l'eau, et (les ayant retirées quelques tems après) les essuyant à l'extérieur avec un linge, ou autrement, le mieux qu'on peut.

La meilleure manière d'en faire un instrument aussi durable qu'on peut le souhaiter, seroit d'enfermer et retenir l'eau interposée à chaque couple de métaux, et de fixer ces mêmes plateaux à leurs places, en enveloppant de cire ou de poix toute la colonne; mais la chose est un peu difficile pour l'exécution, et exige beaucoup de patience. J'y ai pourtant réussi; et j'ai formé, de cette manière, deux cilindres de 20 couples métalliques, qui me servent encore assez bien, après quelques semaines, et serviront, j'espère, après des mois.

On a la commodité de pouvoir employer ces cilindres aux expériences, non seulement debout, mais inclinés, ou couchés, comme on veut, et même plongés dans l'eau, la tête seulement dehors: ils pourroient encore donner la commotion plongés entièrement, s'ils contenoient un nombre plus grand de plateaux, ou si plusieurs de ces cilindres étoient joints ensemble, et qu'il y eût quelqu'interruption, qu'on pût ôter à volonté, &c. avec quoi, ces cilindres imiteroient assez bien l'anguille tremblante; pour mieux ressembler à laquelle, même dans l'extérieur, ils pourroient être joints ensemble par des fils métalliques pliables, ou des ressorts à boudin, et être couverts dans toute la longueur d'une peau, et se terminer en une tête et en une queue, bien configurées, &c.

Les effets sensibles à nos organes que produit un appareil formé de 40 ou 50 paires de plateaux, (et même un moins grand, si l'un des métaux étant argent ou cuivre, l'autre est zinc,) ne

se reduisent pas simplement aux commotions : le courant de fluide électrique, mu et sollicité par un tel nombre et espèces de conducteurs différents, argent, zinc, et eau, alternativement disposés de la manière décrite, n'excite pas seulement des contractions et spasmes dans les muscles, des convulsions plus ou moins violentes dans les membres qu'il traverse dans son cours, mais il irrite aussi les organes du goût, de la vue, de l'ouie, et du tact, proprement dit, et y produit des sensations propres à chacun.

Et, premièrement, quant au sens du tact ; si, au moyen d'un ample contact de la main (bien humectée) avec une lame métallique, ou mieux, en plongeant la main profondément dans l'eau du bassin, j'établis d'un côté une bonne communication avec une des extrémités de mon *appareil électro-moteur*, (il faut donner de nouveaux noms à des instruments nouveaux, non seulement par la forme, mais aussi par les effets, ou par le principe d'où ils dependent,) et de l'autre côté j'applique le front, la paupière, le bout du nez, aussi humectés, ou quelque autre partie du corps où la peau soit assez délicate ; j'applique, dis-je, avec un peu de pression, quelqu'une de ces parties delicates, bien humectées, contre la pointe d'un fil métallique, qui va communiquer convenablement à l'autre extrémité du dit appareil, je sens, au moment que s'accomplit ainsi le cercle conducteur, à l'endroit touché de la peau, et un peu au-delà, un coup et une piqûre, qui passent vite, et se repètent autant de fois qu'on interrompt et rétablit ce cercle ; de sorte que, si ces alternatives sont fréquentes, elles me causent un trémoussement, et un picotement fort désagréable. Mais, si toutes les communications continuent sans ces alternatives, sans la moindre interruption du cercle, je ne ressens plus rien pour quelques moments ; passés lesquels, commence à la partie appliquée au bout du fil métallique, une

autre sensation, qui est une douleur aigue, (sans secousse,) limitée précisément aux points du contact, une cuisson, non seulement continuée, mais qui va toûjours en augmentant, au point de devenir en peu de tems insupportable, et qui ne cesse qu'en interrompant le cercle.

Quelle preuve plus évidente de la continuation du courant électrique, pour tout le tems que les communications des conducteurs qui forme le cercle continuent ? et que seulement en interrompant celui-ci, un tel courant est suspendu ? Cette circulation sans fin du fluide électrique, (ce *mouvement perpetuel,*) peut paroitre paradoxe, peut n'être pas explicable; mais elle n'en est pas moins vraie et réelle, et on la touche, pour ainsi dire, des mains. Une autre preuve evidente peut aussi se tirer, de ce que, dans ces sortes d'expériences, on éprouve souvent, au moment qu'on interrompt brusquement le cercle, un coup, une piqûre, une commotion, suivant les circonstances, tout comme au moment qu'on le complete; avec la seule différence, que ces sensations, causées par une espèce de reflux du fluide électrique, ou par le secousse qui naît de la suspension soudaine de son courant, sont plus foibles. Mais je n'ai pas besoin, et ce n'est pas ici le lieu, d'alléguer les preuves d'une telle circulation sans fin du fluide électrique, dans un cercle de conducteurs où il y en a qui, pour être de différente espèce, font par leur contact mutuel, l'office d'excitateurs ou *moteurs :* cette proposition, que j'ai avancée dès mes premières recherches et découvertes au sujet du GALVANISME, et toûjours soutenue, en l'appuyant de nouveaux faits et expériences, n'aura plus, j'espére, de contradicteurs.

Revenant à la sensation de douleur qu'on éprouve dans les expériences décrites ci-dessus, je dois ajouter, que si cette dou-

leur est assez forte et piquante dans les parties que la peau recouvre, elle l'est beaucoup plus où la peau a été enlévé, dans les blessures, par exemple, et les plaies recentes. Si par hazard il y a une petite incision, ou écorchure, au doigt que je plonge dans l'eau communiquante avec une des extrémités de l'appareil électro-moteur, j'y ressens une douleur si vive et si cuisante, lorsqu'en établissant la communication convenable avec l'autre extrémité j'en complete le cercle, que je dois bientôt me désister de l'expérience, c'est-à-dire, retirer le doigt, ou interrompre de quelque autre manière ce cercle. Je dirai de plus, que je ne puis pas même resister au-delà de quelques secondes, lorsque la partie de l'appareil que je mets en jeu, ou l'appareil entier, ne va qu'à 20 couples métalliques, ou environ.

Une chose que je dois encore faire remarquer, c'est, que toutes ces sensations de picotement et de douleur sont plus fortes et plus aigues, les autres choses égales, lorsque la partie du corps qui doit les ressentir se trouve du côté de l'électricité négative, c'est-à-dire, placée de manière, dans le cercle conducteur, que le fluide électrique parcourant ce cercle, ne soit pas dirigé contre cette partie sensible, qu'il ne s'avance pas vers elle et y entre de dehors en dedans, mais bien que sa direction soit de dedans en dehors, en un mot, qu'il en sorte : par rapport à quoi, il faut connoître, des deux métaux qui entrent par couples dans l'appareil construit, quel est celui qui donne à l'autre. Or, j'avois déjà determiné cela pour tous les métaux, par d'autres expériences, publiées il y a long-tems, à la suite de mes premiers mémoires au sujet du GALVANISME. Je ne dirai donc ici autre chose, sinon que tout est pleinement confirmé, par les expériences également et encore plus démonstratives et éclatantes, qui m'occupent à présent.

Par rapport au sens du goût, j'avois déjà découvert, et publié dans ces premiers mémoires, où je me vis obligé de combattre la prétendue électricité animale de GALVANI, et de la déclarer une électricité extrinséque, mue par le contact mutuel des métaux de différente espèce; j'avois, dis-je, découvert, en conséquence de ce pouvoir que j'attribuois aux métaux, que deux piéces de ces métaux différents, et singulièrement une d'argent et une de zinc, appliquées convenablement, excitoient, sur le bout de la langue, de sensations de saveur très-marquées; que la saveur etoit decidément acide, si, le bout de la langue étant tourné vers le zinc, le courant électrique alloit contre lui, et entroit; et qu'une autre saveur, moins forte, mais plus désagréable, acre, et tirante à l'alcalin, se faisoit sentir, si (la position des métaux étant renversée) le courant électrique sortoit du bout de la langue; que ces sensations, au surplus, continuoient, et recevoient même des accroissements, pendant plusieurs secondes, si le contact mutuel des deux métaux se soutenoit, et le cercle conducteur n'étoit nulle part interrompu. Or, quand j'ai dit ici, que les mêmes phénomènes arrivent ponctuellement, lorsqu'on met à l'épreuve, au lieu d'une seule couple de ces piéces métalliques, un assemblage de plusieurs, arrangés comme il faut; et que les dites sensations de saveur, soit acide, soit alcaline, augmentent, mais peu, avec le nombre de ces couples, j'ai presque tout dit. Il me reste seulement à ajouter, que si l'appareil qu'on met en jeu pour ces expériences sur la langue, est formé d'un nombre assez grand de couples métalliques de cette espèce, si, par exemple, il en contient 30, 40, ou davantage, la langue n'éprouve pas uniquement la sensation de saveur qu'on vient de dire, mais, en outre, celle d'un coup, qui la frappe à l'instant qu'on complète le cercle, et qui lui cause une piqûre plus

ou moins douloureuse, mais passagère, suivie, quelques moments après, de la sensation durable de saveur. Ce coup produit même une convulsion, ou trémoussement, d'une partie, ou de toute la langue, lorsque l'appareil, formé d'un plus grand nombre encore de couples des dits métaux, est plus actif, et que, moyennant de bonnes communications conductrices, le courant électrique qu'il excite peut passer partout, avec assez de liberté.

Je reviens souvent, et j'insiste, sur cette dernière condition, parcequ'elle est essentielle, pour toutes les expériences où il s'agit d'obtenir des effets bien sensibles sur notre corps, soit des commotions dans les membres, soit des sensations dans les organes des sens. Il faut donc, que les conducteurs non-métalliques qui entrent dans le cercle, soient des bons conducteurs autant que possible, bien imbibés (s'ils ne sont pas des liquides eux-mêmes) d'eau, ou de quelque autre fluide plus conducteur que l'eau pure; et il faut, outre cela, que les surfaces bien humides, par lesquelles ils communiquent avec les conducteurs métalliques, et sur-tout entr'eux, soient assez larges. La communication doit seulement être retrecie, ou réduite à un petit nombre de points de contact, là où l'on veut concentrer l'action électrique sur une partie des plus sensibles du corps, sur quelques nerf des sens, &c. comme je l'ai déjà fait remarquer, à propos des expériences sur le tact, savoir, des expériences par lesquelles on excite des douleurs aigues dans différentes parties. Ainsi donc, la meilleure manière que j'ai trouvée, de produire sur la langue toutes les sensations décrites, est, d'appliquer son bout contre l'extrémité pointue (qui ne le soit pas pourtant trop), d'une verge métallique, que je fais communiquer convenablement, comme dans les autres expériences, à

une des extrémités de mon appareil, et d'établir un bonne communication de la main, ou, ce qui est mieux, des deux mains ensemble, avec l'autre extrémité. Cette application du bout de la langue au bout de la verge métallique, peut, au reste, ou exister déjà, lorsqu'on va faire l'autre communication pour completer le cercle, (lorsqu'on va plonger la main dans l'eau du bassin,) ou se faire après l'établissement de cette communication, pendant que la main se trouve plongée; et, dans ce dernier cas, je crois sentir la piqûre et la secousse dans la langue, un tant-soit-peu avant le véritable contact. Oui, il me paroit toûjours, particulièrement si j'avance peu-à-peu le bout de la langue, que lorsqu'il est arrivé à une très-petite distance du métal, le fluide électrique, (je voudrois presque dire l'étincelle,) franchissant cet intervalle, s'élance pour le frapper.

A l'égard du sens de la vue, que j'avois aussi découvert pouvoir être affecté par le foible courant du fluide électrique, procédant du contact mutuel de deux métaux differents, en général, et en particulier d'une piéce d'argent avec une de zinc, je devois m'attendre, que la sensation de lumière excitée par mon nouvel appareil, seroit plus forte, à mesure qu'il contiendroit un plus grand nombre de piéces de ces métaux; chaque couple desquels, arrangées comme il faut, ajoute un dégré de force au dit courant électrique, comme toutes les autres expériences le montrent, et notamment celles avec l'électrometre, aidé du condensateur, que j'ai seulement indiquées, et que je décrirai ailleurs. Mais je fus surpris de trouver, qu'avec 10, 20, 30 couples, et davantage, l'éclair produit ne paroissoit ni plus long et étendu, ni beaucoup plus vif, qu'avec une seule couple. Il est vrai, cependant, que cette sensation de lumière foible et passagère, est excitée par un tel appareil plus aisément. et de plusieurs manières. En

effet, pour réussir avec une seule couple, il n'y a, à-peu-près, que les manières suivantes; savoir, ou qu'une des piéces métalliques soit appliquée au bulbe même de l'œil, ou à la paupière, bien humectée, et qu'on la fasse toucher à l'autre métal appliqué à l'autre œil, ou tenu dans la bouche, ce qui donne le plus bel éclair; ou, qu'on empoigne cette second piéce métallique, avec la main bien humectée, et qu'on la porte au contact de la première; ou enfin, qu'on applique ces deux lames à certaines parties de l'intérieur de la bouche, en les faisant aussi communiquer entr'elles. Mais, avec un appareil de 20, 30 couples, &c. on produit le même éclair, en appliquant au bout d'une lame ou verge métallique, qui soit en communication avec une des extremités de cet appareil, tandis que d'une main on communique convenablement avec l'autre extremité; en appliquant, dis-je, ou faisant toucher à cette lame, non seulement l'œil, ou quelque partie que se soit de la bouche, mais le front, le nez, les joues, les levres, le menton, et jusqu'à la gorge; en un mot, toutes les parties et points du visage, qu'on doit seulement avoir bien humectés, avant de les porter au contact de la lame métallique. Au reste, la forme, comme la force, de cette lumière passagère qu'on appercoit, varie un peu, en variant les endroits de la face sur lesquels on porte l'action du courant électrique; si c'est sur le front, par exemple, cette lumière est médiocrement vive, et paroit comme un cercle lumineux, sous laquelle figure elle se présente aussi dans plusieurs autres essais.

Mais la plus curieuse de toutes ces expériences, est de tenir la lame métallique serrée entre les levres, et en contact du bout de la langue; puisque, lorsqu'on vient ensuite completer le cercle, de la manière convenable, on excite à la fois, si l'appareil est suffisamment grand, en bon ordre, et le courant électrique

assez fort et en bon train, une sensation de lumière dans les veux, une convulsion dans les levres, et même dans la langue, une piqûre douloureuse sur son bout, suivie enfin de la sensation de saveur.

Je n'ai plus qu'à dire un mot sur l'ouie. Ce sens, que j'avois inutilement cherché à exciter avec deux seules lames métalliques, quoique les plus actives entre tous les *moteurs* d'électricité, savoir, une d'argent, ou d'or, et l'autre de zinc, je suis enfin parvenu à l'affecter avec mon nouvel appareil, composé de 30 ou 40 couples de ces métaux. J'ai introduit, bien avant dans les deux oreilles, deux espèces de sondes ou verges métalliques, avec les bouts arrondis; et je les ai fait communiquer immédiatement aux deux extrémités de l'appareil. Au moment que le cercle a été ainsi complété, j'ai reçu une secousse dans la tête ; et, quelques moments après, (les communications continuant sans aucune interruption,) j'ai commencé à sentir un son, ou plutôt un bruit, dans les oreilles, que je ne saurois bien définir ; c'étoit une espèce de craquement à secousse, ou petillement, comme si quelque pâte ou matière tenace bouillonnoit. Ce bruit continua sans relâche, et sans augmentation, tout le tems que le cercle fut complet, &c. La sensation désagréable, et que je craignis dangereuse, de la secousse dans le cerveau, a fait que je n'ai pas repété plusieurs fois cette expérience.

Reste le sens de l'odorat, que j'ai tenté jusqu'ici inutilement, avec mon appareil Le fluide électrique, qui, mis en courant dans un cercle complet de conducteurs, produit dans les membres et parties des corps vivants qui se trouvent comprises dans ce cercle, des effets correspondants à leur excitabilité; qui, stimulant particulièrement les organes ou nerfs du tact, du goût, de la vue, et de l'ouie, y excite quelques sensations propres à

chacun de ces sens, comme nous avons trouvé, ne produit, dans l'intérieur du nez, qu'un picotement plus ou moins douloureux, et des commotions plus ou moins étendues, selon que le dit courant est plus ou moins fort. Et d'où vient donc, qu'il n'y excite aucune sensation d'odeur, quoiqu'il arrive, comme il paroit, à stimuler les nerfs de ce sens? On ne peut pas dire, que le fluide électrique, par lui-même, ne soit pas propre à produire des sensations odorantes; puisque, lorsqu'il se repand dans l'air, en forme d'aigrettes, &c. dans les expériences ordinaires des machines électriques, il porte au nez une odeur très-marquée, ressemblante à celle du phosphore. Je dirai donc, avec plus de ressemblance, et sur un fondement d'analogie avec les autres matières odoriférantes, qu'il faut justement qu'il se repande dans l'air, pour exciter l'odorat; qu'il a besoin, comme les autres effluves, du vehicule de l'air, pour affecter ce sens de la manière propre à y faire naître les sensations d'odeur. Or, dans les expériences dont il est question, c'est-à-dire, du courant électrique dans un cercle de conducteurs tous contigus, et sans la moindre interruption, cela ne peut absolument avoir lieu.

Tous les faits que j'ai rapporté dans ce long écrit, touchant l'action que le fluide électrique, incité et mu par mon appareil, exerce sur les différentes parties de notre corps, que son courant envahit et traverse; action qui, au surplus, n'est pas momentanée, mais soutenue et durable pour tout le tems que, les communications n'étant point interrompues, ce courant suit son train; action, enfin, dont les effets varient suivant la différente excitabilité de ces parties, comme on a vu; tous ces faits, déjà assez nombreux, et d'autres qu'on pourra encore découvrir, en multipliant et variant les expériences de ce genre, vont ouvrir un champ assez vaste de reflexions, et des vuës, non seulement

curieuses, mais intéressantes particulièrement la médecine. Il y en aura pour occuper l'anatomiste, le physiologiste, et le practicien.

On sçait, par l'anatomie qui en a été faite, que l'organe électrique de la torpille, et de l'anguille tremblante, consiste en plusieurs colonnes membraneuses, remplies d'un bout à l'autre d'un grand nombres de lames ou pellicules, en forme de disques très-minces, couchées les unes sur les autres, ou soutenues à de très-petits intervalles, dans lesquels coule, comme il paroit, quelque humeur. Or, on ne peut pas supposer, qu'aucune de ces lames soit isolante, comme le verre, les resines, la soye, &c. et moins encore, qu'elles puissent, ou s'électriser par frottement, ou être disposées et chargées à la maniere de petits tableaux FRANKLINIENS, ou de petits électrophores; ni méme, qu'elles soient d'assez mauvais conducteurs pour faire l'office d'un bon et durable condensateur, comme l'a imaginé Mr. NICHOLSON. L'hypothése de ce savant et laborieux physicien, par laquelle il fait de chaque paire de ces pellicules, qu'il voudroit comparer à des feuilles de talc, autant de petits *électrophores* ou *condensateurs*, est, à la vérité, très-ingenieuse; c'est peut-étre ce qu'on a imaginé de mieux pour l'explication des phénomènes de la torpille, en se tenant aux principes et loix connues jusqu'ici en électricité. Mais, outre que le mécanisme par lequel devroit s'opérer, pour chaque coup que ce poisson voudroit donner, la séparation respective des plateaux, de tous ou d'un grand nombre de ces électrophores ou condensateurs; devroient, dis-je, s'opérer toutes ces séparations à la fois, et s'établir, d'un côté, une communication entr'eux de tous les plateaux *électrisés en plus*, et, de l'autre côté, une communication de tous ceux *électrisés en moins*, comme le veut Mr. NICHOLSON; outre que ce

mécanisme très-compliqué paroit trop difficile, et peu naturel; outre que la supposition d'une charge électrique, originairement imprimée, et si durable, dans ces pellicules faisant l'office d'électrophores, est tout-à fait gratuite; une telle hypothése tombe entièrement, vu que ces pellicules de l'organe de la torpille ne sont, et ne peuvent être, aucunement isolantes, ou susceptibles d'une véritable charge électrique, et moins encore capables de la retenir. Toute substance animale, tant qu'elle est fraiche, entourée d'humeurs, et plus ou moins succulente elle-méme, est un assez bon conducteur : je dis plus ; bien loin d'être aussi *cohibente* que les resines, ou le talc, aux feuilles duquel Mr. NICHOLSON cherche à comparer les pellicules dont il est question, il n'y a point, comme je me suis assuré; de substance animale vivante, ou fraiche, qui ne soit meilleur *déférente* que l'eau, excepté seulement la graisse, et quelques humeurs huileuses. Mais, ni ces humeurs, ni la graisse, sur-tout à demi fluide, ou fluide entièrement, comme elle se trouve dans les animaux vivants, peut recevoir une charge électrique, à la manière des lames isolantes, et la retenir; d'ailleurs, on ne trouve pas, que les pellicules et les humeurs de l'organe de la torpille soient graisseuses ou huileuses. Ainsi donc, cet organe, formé uniquement de substances conductrices, ne peut être rapporté, ni à l'électrophore ou condensateur, ni à la bouteille de Leyde, ni à une machine quelconque excitable, soit par frottement, soit par quelque autre moyen capable d'électriser des corps isolants, qu'on a toujours crus, avant mes découvertes, les seuls originairement électriques.

A quelle électricité donc, a quel instrument, doit-il être comparé, cet organe de la torpille, de l'anguille tremblante, &c. ? à celui que je viens de construire, d'après le nouveau principe d'électricité que j'ai découvert il y a quelques années, et que

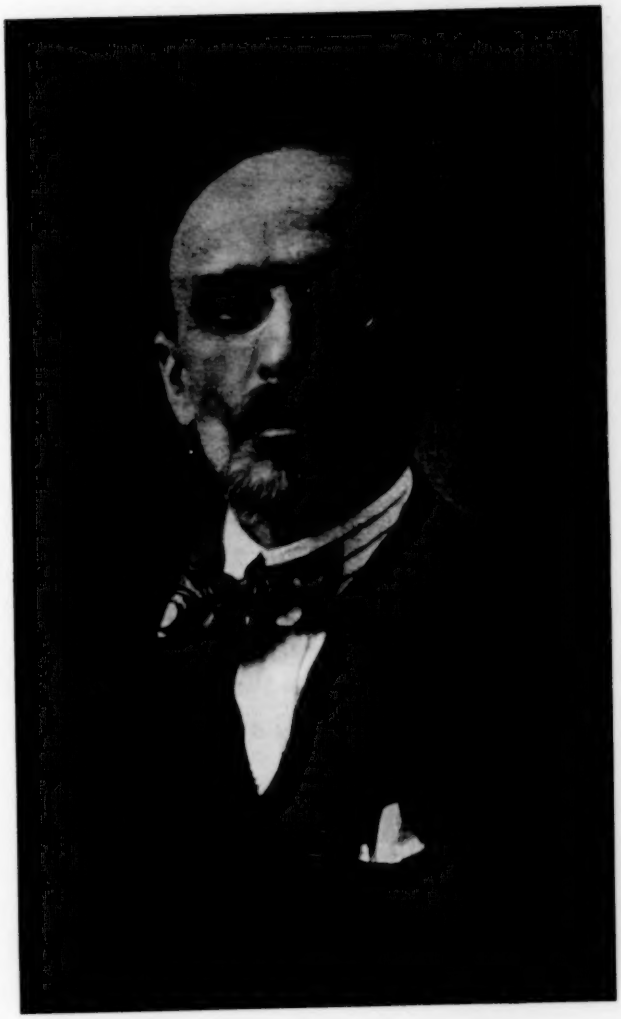
mes expériences successives, sur-tout celles qui m'occupent maintenant, ont si bien confirmé, savoir, que les conducteurs sont aussi, dans certains cas, moteurs d'électricité, dans le cas du contact mutuel de ceux de différente espèce, &c. à cet appareil, que j'ai nommé *Organe électrique artificiel*, et qui, étant dans le fond le même que l'organe naturel de la torpille, le ressemble encore pour la forme, comme j'ai déjà avancé.

Eugenio Rignano
(1870-1930)

RIGNANO qui vient de mourir à Milan (9 février 1930) fut un admirable type de synthétiseur; il eut le tourment de l'unité et sa vie entière fut consacrée à la synthèse de nos connaissances. A une époque où les efforts synthétiques sont le plus souvent méconnus et discrédités, il a eu le courage, la foi, et la tenacité de s'y dévouer de tout son esprit et de tout son cœur. J'imagine que les philosophes professionnels le trouvèrent trop savant, et les savants, trop philosophe, mais peu importe, il fut ce qu'il fut, et il le fut avec une constance et un zèle qui feront vivre sa mémoire.

Né à Livourne le 31 mai 1870, il fit ses études à la Faculté des sciences de Pise, puis à l'École polytechnique de Turin. Il fut reçu ingénieur en 1893, mais à ce moment son esprit était déjà dominé par des préoccupations philosophiques et synthétiques. Ses études mathématiques et techniques n'en furent pas moins le meilleur des apprentissages. Il ne fut jamais attaché à aucune université, sinon à titre honoraire; ceci présente des inconvénients, mais aussi de grands avantages ; car il eut ainsi plus de liberté et de loisir.

Sa qualité de directeur de la revue *Scientia* le fit connaître d'un très grand public, — on pourrait dire, de tout le public scientifique vraiment cultivé. *Scientia*, ou plus exactement la *Rivista di scienza* fut fondée en 1907 par un comité de cinq savants italiens : G. BRUNI, A. DIONISI, F. ENRIQUES, A. GIARDINA et E. RIGNANO. Un peu plus tard le sous-titre *Scientia* fut introduit, et en 1910, ce sous-titre devint le titre principal. En juillet 1915 (vol. 18), RIGNANO devint le seul directeur. La guerre augmenta beaucoup la prospérité de cette revue publiée dans un pays neutre, et RIGNANO sut profiter habilement des circonstances. Son idée de publier une traduction française de tous les articles non-français fut une vraie trouvaille qui contribua puissamment à l'essor de *Scientia*.



EUGENIO RIGNANO
1870-1930

G. SARTON.

UNIV. OF MICH.

La meilleure partie de son activité scientifique est postérieure à la création de *Scientia*, et cependant les trois volumes publiés par lui avant 1907 contenaient en germe l'essentiel de ses idées.

Je n'ai pas l'intention de discuter ici ces idées, ce qui nous conduirait beaucoup trop loin, mais seulement d'esquisser leur développement et d'indiquer ainsi la belle unité de son esprit. Son point de vue fut toujours purement synthétique. Il fut essentiellement un médiateur, et cela explique que ses opinions ne furent jamais populaires en dépit du fait qu'elles bénéficièrent d'une publicité considérable. En effet on se rappelle beaucoup mieux les opinions extrêmes que les moyennes, et l'obscurité relative des idées de RIGNANO, malgré leur diffusion abondante, n'est que la récompense ordinaire de tous les arbitrages intellectuels.

Son premier maître en sociologie et en philosophie fut AUGUSTE COMTE, et il resta toute sa vie un positiviste, mais un positiviste doux et généreux, assoiffé d'idéal et de liberté. Son deuxième livre fut une étude de la sociologie comtienne (1902). Avant cela il avait publié un autre livre (1901) où il essayait d'harmoniser sa foi socialiste avec les idées économiques de l'école libérale. Ce fut là son premier compromis, un compromis qui comme de juste ne put satisfaire entièrement ni les uns ni les autres. Il est relativement facile pour un esprit aussi synthétique et aussi généreux que celui de RIGNANO de résoudre des antinomies; la difficulté c'est de faire admettre son arbitrage par autrui. Or quels arguments sont assez solides pour l'emporter sur deux groupes opposés de préjugés ? Il arriva à RIGNANO ce qui arriva à tous les médiateurs : il ne put convaincre que très peu de personnes, et encore celles-ci ne furent presque toujours que des spectatrices désintéressées et sans importance, non pas celles qui étaient déjà engagées dans la lutte.

Son deuxième grand effort d'arbitrage fut son intervention entre les néo-Darwinistes et les néo-Lamarckiens. Les caractères acquis sont-ils transmissibles comme le veulent ceux-ci, ou ne le sont-ils pas comme le maintiennent ceux-là ? RIGNANO suggéra l'hypothèse d'une centro-épigénèse (1906), d'après laquelle la transmission s'opérerait par une sorte de mécanisme mnémonique. Mais était-ce là une vraie explication ou simplement une métaphore ? Ces réflexions le conduisirent naturellement à essayer de réconcilier les vitalistes et les mécaniciens, ce qui revient en somme à résoudre

l'énigme de la vie. Il fit preuve dans tout cela de beaucoup d'érudition, de sagesse et de subtilité mais apparemment l'énigme n'a pas encore été résolue puisque les biologistes n'ont pas interrompu leurs querelles.

Enfin, de la biologie il passa tout naturellement à la psychologie. Qu'est ce que le raisonnement ? Il en expliqua l'origine et la nature mnémonique, et démontra le caractère affectif de la pensée même la plus abstraite. Ceci le conduisit à un nouvel essai de médiation entre la thèse anglaise de l'associationisme et la théorie allemande de la forme (« Gestalt »). Il conclut que l'activité affective imprègne toutes les manifestations de la pensée et construit celle-ci de toutes pièces en s'aidant de toutes les accumulations mnémoniques sensorielles de notre substance. Ainsi ces propriétés mnémoniques lui permettaient d'expliquer le développement individuel, l'hérédité, le finalisme de la vie, la pensée même, toute la gamme de l'intelligence animale et humaine. La biologie et la psychologie étaient profondément unifiées. RIGNANO ne s'arrêta pas là, mais s'efforça d'appliquer sa méthode et ses idées directrices à la solution des difficultés morales de notre époque, au réajustement social du monde déséquilibré par la guerre.

Qu'il me soit permis de terminer cette esquisse par quelques souvenirs personnels. Quoique j'ai été en correspondance avec lui pendant de longues années, je ne l'ai vu qu'une fois — ou plutôt trois fois en trois jours successifs, du 24 au 26 novembre 1919 à Milan. Le premier jour je lui fis une longue visite, le deuxième je dinai chez lui, le troisième il me fit visiter les bureaux de *Scientia* et m'expliqua le mécanisme de publication qu'il avait poussé fort loin. A ce moment il s'intéressait beaucoup à des problèmes d'organisation du travail, et me posa une foule de questions pour savoir comment j'organisais ma propre vie intellectuelle. D'ailleurs sa curiosité ne s'arrêtait pas à l'organisation intellectuelle ; il avait appris à apprécier l'importance de toute organisation et tout mécanisme qui put simplifier la vie, tout au moins, celle des gens intelligents. Par exemple, je me souviens de son enthousiasme au sujet des rasoirs de sûreté, dont il venait apparemment de faire la découverte. (1) Combien de temps les

(1) En réalité l'invention date du début du XXe siècle mais elle ne se répandit que fort lentement en Europe.

Italiens n'ont-ils pas perdu, qu'ils le voulussent bien ou non, dans les boutiques des barbiers ! RIGNANO se souvenait de cela et il considérait l'inventeur du rasoir de sûreté comme un des bienfaiteurs de l'humanité.

En attendant que son œuvre personnelle soit mieux comprise et plus populaire, le plus beau monument de RIGNANO, ce sont les volumes de *Scientia* édités par lui, près d'une cinquantaine de gros volumes que les savants qui écriront plus tard l'histoire intellectuelle de notre temps devront consulter sans cesse. Ce sera d'ailleurs un monument bien vivant, car *Scientia* continuera de vivre et de prospérer. Elle est dirigée maintenant par un triumvirat se composant de F. BOTTAZZI et de deux membres du comité primitif (1907-15), G. BRUNI et F. ENRIQUES (2).

Le portrait illustrant cet article est dû à l'amabilité du dévoué secrétaire général de *Scientia*, M. le Dr. P. BONETTI.

Intervale, New Hampshire GEORGE SARTON.
août 1930.

ŒUVRES PRINCIPALES

I. Di un socialismo in accordo con la dottrina economica liberale (Edition française, GIARD & BRIÈRE, Paris, 1904; Édition italienne, FRATELLI BOCCA, Torino, 1901).
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III. Sulla trasmissibilità dei caratteri acquisiti. Ipotesi di una centroepigenesi (Édition française, ALCAN, Paris, 1906; Édition italienne, ZANICHELLI, Bologna, 1907; Édition allemande, ENGELMANN, Leipzig, 1907; Édition anglaise, The Open Court Publishing Co., London, Chicago, 1911).
IV. Saggi di sintesi scientifica (Édition française, ALCAN, Paris, 1912; Édition anglaise, GEORG ALLEN & UNWIN, London, 1918; Édition espagnole, ATENEA, Madrid, 1923).
V. Psicologia del ragionamento (Édition française, ALCAN, Paris, 1920; Édition italienne, ZANICHELLI, Bologna, 1920; Édition

(2) Ce dernier, qui fut un camarade d'université de RIGNANO, lui a consacré une étude dans *Scientia :* I motivi della filosofia di EUGENIO RIGNANO (juin 1930).

anglaise, KEGAN PAUL, TRENCH, TRUBNER & Co., London, 1923; Édition espagnole, CALPE, Madrid, 1923). Voir *Isis*, 4, 90-93, 1921.

VI. La memoria biologica. Saggio di una nuova concezione filosofica della vita (Édition française, FLAMMARION, Paris, 1923; Édition italienne, ZANICHELLI, Bologna, 1922). Voir *Isis*, 6, 564-65, 1924.

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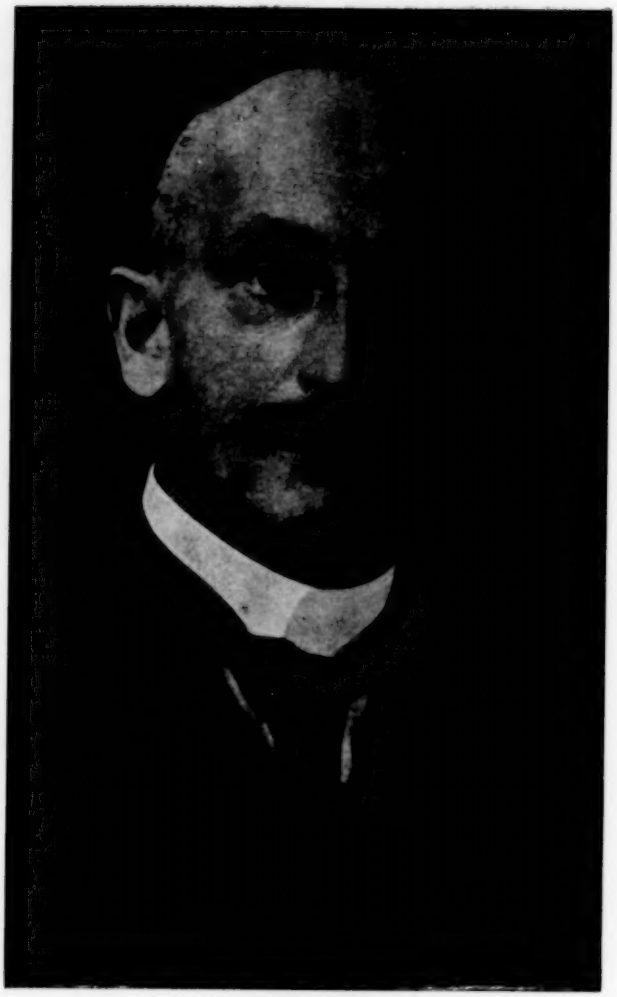
VIII. Che cosa è la vita? Nuovi saggi di sintesi biologica (Édition italienne, ZANICHELLI, Bologna, 1926; Édition française, ALCAN, Paris, 1927; Édition partielle anglaise sous le titre, Man not a machine. A study of the finalistic aspects of life, KEGAN PAUL, etc., London, 1926).

IX. Problemi della psiche (Édition italienne, ZANICHELLI, Bologna, 1928; Édition française, ALCAN, Paris, 1928),

X. Il fine dell' uomo. Prime linee fondamentali di un sistema di morale fondato sull' armonia della vita (Édition italienne ZANICHELLI, Bologna, 1923; Édition anglaise, The Open Court Publishing Company, Chicago, 1929).



Isis, XV, pl. 5 CARL SCHOCH A. POGO.
1873-1929

UNIV OF MICH.

Carl Schoch
(1873-1929)

Per aspera ad astra

CARL SCHOCH died in Berlin on November 19, 1929, in his fifty-seventh year. He was in his early fifties when he began the publication of a series of articles and tables of fundamental importance to orientalists and to astronomers. SCHOCH's interest in astronomical problems of a chronological nature can be traced back to his high-school days; his work in this field was an avocation during the quarter of a century he spent in the insurance business; the post-war turmoil gave the middle-aged actuary an opportunity to do—in a few crowded years—his scientific life work.

CARL SCHOCH, the son of a *Rittergutsbesitzer*, was born in Pilgram, Mark Brandenburg, on March 5, 1873. He spent the first decade of his life on the country estate, where private tutoring put sound foundations for his future studies. In 1884 he was sent to Frankfurt an der Oder; his mathematical and linguistic abilities and accomplishments won him honors at the *Gymnasium;* the parallel progress of his piano studies was no less noteworthy. From 1893 to 1898 he studied in Marburg and in Berlin—mathematics, law, philology, music.

The first twenty-five years of SCHOCH's life—his *Lehr-und Wanderjahre*—gave promise of valuable scientific contributions. A quarter of a century of actuarial work in Mannheim followed, 1898-1922. An indefinite period of the same kind of occupation in Ludwigshafen was in prospect, when the French occupation put an end to SCHOCH's eclipse in the insurance business.

From the point of view of the history of science, the harvest period of SCHOCH's life began in 1924. He first went to Oxford, where he collaborated with J. K. FOTHERINGHAM; in 1926 he began his work at the Astronomisches Recheninstitut in Berlin-Dahlem; in 1929 he died. His scientific life ended as abruptly and untimely as it began.

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From the astronomical point of view, the most important papers of SCHOCH are : *Die säkulare Acceleration des Mondes und der Sonne* (26.16), the *Verbesserung der Schramschen Sonnenfinsternis-Tafeln* (26.15), and *Die Neubearbeitung der Syzygientafeln von* OPPOLZER (28.6). The improvement of the elements of the motion of the moon hinges on the interpretation of the following (1) reference to HIPPARCHOS in PAPPOS (and THEON) : *ἐν γὰρ τῷ πρώτῳ περὶ μεγεθῶν καὶ ἀποστημάτων λαμβάνει φαινόμενον τοῦτο· ἔκλειψιν ἡλίου ἐν μὲν τοῖς περὶ τὸν Ἑλλήσποντον τόποις ὅλου τοῦ ἡλίου ἀκριβῶς γεγενημένην ὥστε μηδὲν αὐτοῦ παραφαίνεσθαι, ἐν Ἀλεξανδρείᾳ δὲ τῇ κατ' Αἴγυπτον τὰ δ̄* (THEON : *τέσσαρα*) *μάλιστα πεμπτημόρια τῆς διαμέτρου ἐκλελοιπότα.* Was the « phenomenon » used by HIPPARCHOS, in his investigation of the size and distance of the Sun and the Moon, the well-known AGATHOCLES eclipse of 310 B. C.—the first solar eclipse since the foundation of Alexandria which was total at the Hellespont—or was it the eclipse of 129 B. C. which occurred while HIPPARCHOS was still active ? SCHOCH followed the traditional interpretation of HIPPARCHOS' « phenomenon », assumed that the eclipse of 129 B. C. was total at the Hellespont, and tried to adjust correspondingly the corrections to the motion of the node. The three sets of elements in the three papers quoted above were the results of his attempts to account satisfactorily for all the eclipses of the last two millennia. SCHOCH finally realized the futility of his successive compromises, recognized that the « phenomenon » used by HIPPARCHOS could not have been the eclipse of 129 B. C., and gave a corresponding correction to be applied to the quantity P of his *Neubearbeitung der Syzygientafeln*. The application of this definitive correction, by P. V. NEUGEBAUER, (2) to computations—by means of the *Neubearbeitung der Syzygientafeln*—of ancient, mediaeval, and modern eclipses prove the importance, to historians as well as to astronomers, of SCHOCH's contributions to the theory of the Moon.

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(1) F. HULTSCH. HIPPARCHOS über die Grösse und Entfernung der Sonne. *Leipziger Berichte*, phil.-hist. Classe, 52, 186-89, 1900.

(2) *Astronomische Nachrichten*, 237, 223-24, 1929.

Another set of papers dealing with eclipses (26.14; 26.5; 27.2) is of interest to classical scholars and orientalists rather than to astronomers. In *Die Nordfahrt des* AGATHOKLES, SCHOCH has established—securely, in P. V. NEUGEBAUER's (3) opinion—the fact that AGATHOCLES' fleet was in the zone of totality, north of Syracuse, on August 15, 310 B. C. The results of SCHOCH's investigations of the solar eclipses visible in Boghaz Keui (see *Isis*, 15, 269) were used by E. FORRER. SCHOCH's hypothesis concerning the lunar eclipse of 2283 B. C. was accepted by LANGDON (4) for the dating of the destruction of Ur and the end of the reign of IBI-SIN.

The best way of giving a brief account of SCHOCH's contributions (24.3; 25.2; 25.3; 26.4; 28.5; 29.2) to Babylonian calendariography—as distinguished from dynastic chronology based on his eclipse work—is to quote FOTHERINGHAM, (5) at whose request SCHOCH began, about 1923, « the reduction of ancient planetary observations, in order to see whether they afforded evidence of an apparent acceleration ». « SCHOCH computed for me », continues FOTHERINGHAM, « the angular distance of the Sun below the horizon at all late Babylonian observations of first or last visibility of Venus, but as soon as I had introduced him to the Venus tablets his mind began to run on a possible restoration of ancient Babylinian chronology and even on a continuous restoration of the Babylonian calendar by means of the recorded intercalary months. He also formed the idea of using references on contracts to the 30th day of a month as a test for the computed interval between two successive first appearances of the lunar crescent, thus providing a new astronomical criterion for deciding between rival restorations of the Babylonian calendar. In the hope of obtaining more information than was given in KUGLER's *Sternkunde und Sterndienst* about contracts containing intercalary months he entered into a private correspondence with KUGLER, and thus provided that scholar with material which he partly misunderstood and which he used in his *Sternkunde und Sterndienst in Babel*, Buch II, Teil II, Heft 2

(3) *Astronomische Chronologie*, v. 1, p. 131.
(4) *The Venus tablets of* AMMIZADUGA, p. 82.
(5) *The Venus tablets of* AMMIZADUGA, p. 42-43.

(1924), pp. 622-7... The computations, but not the conclusions, contained in those pages are due to SCHOCH, who had compiled, in 1922, tables for the rapid computation of the phases of the Sun, Moon, and planets, and who had also compiled tables for computing the first visibility of the Moon, based on late Babylonian data. He also constructed, in 1924, tables for the rapid conversion of Babylonian dates into dates of the Julian calandar... In June 1924 I engaged SCHOCH to come to Oxford to assist me in a study of the whole problem. Before leaving Germany he had on his own account contributed a brief note on the bearing of astronomy on the subject to *Astronomische Nachrichten*, Band 222 (1924), pp. 27, 28, in which he stated that according to his tables a last visibility of Venus on the evening of Araḫsamna 28 followed by a reappearance on Kislev 1 was possible only in 1971 and 1915 B. C. within the 3.000 years following 3000 B. C. He himself regarded 1915 B. C. as the correct date. »

SCHOCH's very satisfactory solution of the problems presented by the arcus visionis (24.2; 24.3), and the construction of important tables (24.3; 25.2; 28.5) are astronomically noteworthy results of his studies of the Babylonian calendar. A natural by-product of these studies were his papers dealing with Biblical astronomical matters (26.7; 26.8; 28.2; 28.4). His rather casual contribution to Egyptian astronomy (28.3) ought to be mentioned at this point.

The most conspicuous result of SCHOCH's researches in Babylonian astronomy, chronology, and calendariography are, of course, his *Astronomical and calendarial tables* (28.5) annexed to LANGDON-FOTHERINGHAM's *The Venus tablets of* AMMIZADUGA. Of SCHOCH's contributions to the book itself, FOTHERINGHAM (6) has this to say : « The present study is largely the result of SCHOCH's co-operation with me. Almost all the astronomical computations were made by SCHOCH with the aid of his own tables; the restoration of the calendar is my own work, and supersedes a restoration which SCHOCH had attempted with less complete material. The references to 30-day months were collected by SCHOCH and have been verified and revised by me with LANGDON's assistance. The subject was a matter of daily discussions between SCHOCH

(6) Loc. cit., p. 43.

and myself while he resided with me from June to December 1924... In December 1924 M. THUREAU-DANGIN communicated to SCHOCH at the joint request of SCHOCH and LANGDON for use in our work a number of unpublished contracts for division of date-crops belonging to the later years of HAMMURABI... After returning to Germany SCHOCH published on his own responsibility a condensed study of the whole chronological question and concluded in favour of a chronology falling 64 years later than that which I had proposed. This work appeared under the title of AMMIZADUGA, von C. SCHOCH, Selbstverlag, Berlin-Steglitz, Kuhligkshof 5, 1925. A review of the literature of the subject with a brief announcement of his own views and contributions was published by SCHNABEL in Z. A. XXXVI (1925), pp. 109-22, in which he concluded in favour of the chronology which I had proposed. SCHOCH came to the same conclusion in a paper entitled ' Die erste Dynastie von Babylon ', *Klio* XX (1925), pp. 107-9. » See also, in this connection, OTTO NEUGEBAUER, « Zur Frage der astronomischen Fixierung der babylonischen Chronologie », in *Orientalistische Literaturzeitung*, 32, 913-21, 1929 (*Isis*, 14, 491, 1930).

Another extensive and very useful tabular work of SCHOCH, the *Planeten-Tafeln fur jedermann*, (27.1), published in 1927, was ready, in its original form, before the war; P. V. NEUGEBAUER gave, in his *Astronomische Chronologie*, (see *Isis*, 14, 430,1930), simplified rules for the use of some of these tables, thus vindicating the second part of the title of the book. See also the following reviews of SCHOCH's *Planeten-Tafeln fur jedermann :* by J.SCHAUMBERGER, in *Biblica*, 8, 482-84, 1927; and by A. KOPFF, in *Zeitschrift fur Assyriologie*, 38, 111-13, 1928.

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The following chronologically (7) arranged list includes, probably, all of the published writings of SCHOCH. P. V. NEUGEBAUER is editing some papers of SCHOCH which will appear in the *Astronomische Nachrichten*. (8)

(7) In the order of publication, not of writing. The dating is sometimes uncertain, especially in the case of privately published undated papers.

(8) Note added to the proofs. P. V. NEUGEBAUER gives, in the *Astronomische*

24.1 Das Venus-Tablet AMMIZADUGA. *Astronomische Nachrichten*, 222, 27-30, 1924.

24.2 The « arcus visionis » of the planets in the Babylonian observations. *Monthly Notices of the Royal Astronomical Society*, 84, 731-34, 1924. (Dated, July 11, 1924). See *Isis*, 14, 511, 1930.

24.3 The « arcus visionis » in the Babylonian observations, with tables of the Babylonian calendar. 12 p. Oxford, University Observatory, 1924.

24.4 (Excerpts from SCHOCH's correspondence with KUGLER). In : F. X. KUGLER, *Sternkunde und Sterndienst in Babel*, II. Buch, II. Teil, 2. Heft, p. 627, Münster i. W., 1924.

25.1 The visual and absolute stellar magnitude of the heavenly bodies. A popular study. *The Chaldaean*, 6, 21, 1925.

25.2 AMMIZADUGA. 12 p. Berlin-Steglitz, Selbstverlag, 1925.

25.3 Die erste Dynastie von Babylon. *Klio*, 20, 107-109, 1925. (Dated, February 12, 1925).

26.1 Der heliakische Unter- und Aufgang der Venus. *Sirius*, 59, 13-14, 1926.

26.2 The eclipse of ODYSSEUS. *Observatory*, 49, 19-21, 1926.

26.3 Die Datierung des Trojanischen Krieges und der Irrfahrten des ODYSSEUS. *Die Sterne*, 6, 88, 1926.

26.4 Die Dattelernte in Alt-Babylon und die Fixierung des Monatsanfangs nach dem Neulicht. *Zeitschrift für Assyriologie*, 37, 138-39, 1926.

26.5 (Die Boghazköi-Sonnenfinsternisse). 2 p., 1 fig. In : *Forschungen* von EMIL FORRER, 2. Band, 1. Heft, Astronomische Festlegung des SOPPOLULJOMAS, MORSILIS, und AMENOPHIS IV. Berlin, Selbstverlag von Forrer, 1926.

26.6 Venusbeobachtungen. *Sirius*, 59, 134-35, 1926.

26.7 Der Stern des Messias. *Sirius*, 59, 140, 1926.

26.8 Iterum textus cuneiformis de stella magorum ? (By J. SCHAUMBERGER and C. SCHOCH). *Biblica*, 7, 294-301, 1926.

26.9 Die säkulare siderische Retardation des Mondes. *Sirius*, 59, 156-57, 1926.

26.10 Retardation des Mondes. *Sirius*, 59, 214, 1926.

26.11 Über die Lichtstärke, in welcher die Planeten einander erscheinen. *Die Sterne*, 6, 172-175, 1926.

Abhandlungen (Ergänzungshefte zu den *Astronomischen Nachrichten*) Bd. 8, Nr. 2, Kiel 1930, annotated reprints of our items 26.12, 26.16, 27.2, 28.3, and 29.1, valuable additions to our items 27.1 and 28.6, and a paper entitled *Die Verbesserten Syzygientafeln von* C. SCHOCH.

26.12 Die sechs griechischen Dichter-Finsternisse. 2 p., 1 fig. Berlin-Steglitz, Selbstverlag, 1926. See *Isis*, 10, 221, 1928.

26.13 Der Babylonische Horizont. *Sirius*, 59, 226, 1926.

26.14 Die Nordfahrt des AGATHOKLES. Die berühmtesten Sonnenfinsternisse des griechischen Altertums. 1 fig. *Sirius*, 59, 248-250, 1926.

26.15 Verbesserung der SCHRAMschen Sonnenfinsternis-Tafeln. *Sirius*, 59, 274-78, 1926.

26.16 Die säkulare Acceleration des Mondes und der Sonne. 4 p. Berlin-Steglitz, Selbstverlag, Dezember 1926.

26.17 Günstige Sichtbarkeitsbedingungen des Merkur 1927. *Sirius*, 59, 282, 1926.

26.18 Unsrer Sonne Nachbarn im Weltenraum. Berlin-Steglitz, Selbstverlag, 1926.

27.1 Planeten-Tafeln fur jedermann. v p. + XLVI col. (text) + 15 p. (tables). Berlin-Pankow, Linser-Verlag, 1927.

27.2 Die Ur-Finsternis (eine Hypothese !). 2 p. Berlin-Steglitz, Selbstverlag, 31. Dezember 1927.

28.1 Die Chronologie der Dynastie Ur III. 1 p. Berlin-Steglitz, Selbstverlag, 1928.

28.2 CHRISTI Kreuzigung am 14. Nisan. *Biblica*, 9, 48-56, 1928.

28.3 Die Länge der Sothisperiode beträgt 1456 Jahre. Die Neumondfeste. 4 p. Berlin-Steglitz, Selbstverlag, 1928.

28.4 Das Karmel-Neulicht. *Biblica*, 9, 350-52, 1928. (Dated, April 20, 1928).

28.5 Astronomical and calendarial tables. 16 p. (text) + XVI p. (tables). In : LANGDON-FOTHERINGHAM, *The Venus tablets of* AMMIZADUGA. Oxford, University Press, 1928. See *Isis*, 14, 510, 1930.

28.6 Die Neubearbeitung der Syzygientafeln von OPPOLZER. II + 6 p. *Mitteilungen des Astronomischen Rechen-Instituts. Berlin-Dahlem*, Band 2, Nr. 2. Kiel, 1928.

29.1 Erweiterung der Syzygientafeln der Planeten. Berlin-Steglitz, Selbstverlag, 1929.

29.2 Die Schaltjahre von BURSIN I bis IBISIN I in Umma. *Zeitschrift für Assyriologie*, 39, 226-28, 1929.

Cambridge, Mass. ALEXANDER POGO.

Notes and Correspondence

1. The History of Science.

Department of the History of Science of the Carnegie Institution. Twelfth annual report.—On July 1, 1918, Dr. GEORGE SARTON, Editor of *Isis*, was appointed Research associate of the Carnegie Institution of Washington for the study of the history of science. Until 1929 he worked alone. On July 1, 1929, Dr. ALEXANDER POGO, of the Yerkes Observatory, Williams Bay, Wisconsin, was appointed a Fellow of the Institution to be his assistant. Thus far the main task of the Department has been and continues to be the preparation of the *Introduction to the history of science*, of which the first volume From HOMER to OMAR KHAYYAM appeared in 1927. Reports of the work done from 1918 to June 30, 1929 will be found in the *Year Books of the Carnegie Institution* nos. 18 to 28.

The Department is located in the Harvard Library, rooms 185 and 189, Cambridge, Massachusetts.

The present (twelfth) report covers the period July 1, 1929, to June 30, 1930.

1. *Introduction to the History and Philosophy of Science.*—The final redaction of vol. II dealing with the twelfth and thirteenth centuries (From RABBI BEN EZRA to ROGER BACON) is almost completed. The manuscript will be ready this summer, and the volume itself will appear in the spring or summer of 1931.

Considerable material, much of it in an elaborate stage, has already been accumulated for vols. 3 and 4, dealing respectively with the fourteenth and fifteenth centuries. Miss MARY C. WELBORN will help me to investigate more deeply some of the Latin documents; her work will begin on October 1, 1930.

In the meanwhile, Dr. POGO is preparing materials for vol. 5, dealing with the sixteenth century. He has compiled a preliminary checklist of sixteenth century scientists and has devoted his attention thus far to the Portuguese, Spanish and Italian navigators and cosmographers.

2. *Other investigations.*—Dr. POGO has prepared a critical edition of

the anonymous *La conquista del Peru* (Seville, April 1534) which is the earliest detailed account of the Spanish conquest of Peru and of the *Libro ultimo del summario delle Indie occidentali* (Venice, October, 1534); it will be published this summer by the American Academy of Arts and Sciences (vol. 64, 177-286, 1930). He made also a study of the astronomical knowledge of the Egyptians of the eighteenth dynasty (*Isis*, 14, 301-325).

Dr. JEAN PELSENEER of the University of Brussels, a Fellow of the C. R. B. Foundation, spent the academic year in my seminary. He is especially interested in the development of the mathematical and physical sciences in NEWTON's time. (1)

3. *Publication of Isis.*—During the past year I have edited five numbers of *Isis* (39 to 43) forming the end of vol. 12 (pages 451 to 588), vol. 13 (604 p.), and the beginning of vol. 14 (276 p.), a total of 1017 pages, 18 plates, 46 figures. They contain 23 papers, 61 shorter communications and reviews, and 2,056 bibliographic notes. Dr. POGO assisted me in the editing of *Isis*.

4. *Lectures.*—I gave my usual courses at Harvard University and Radcliffe College, and a few special lectures, to wit, one at the Connecticut College for Women and three at Brown University (Colver Lectures, April, 1930). Dr. POGO gave two illustrated talks on the history of astronomy at the Bond Astronomical Club, Harvard College Observatory.

G. S.

Prix Binoux. — Le prix Binoux pour 1928 a été attribué à Mr. ANDRÉ METZ pour l'ensemble de ses écrits sur la théorie d'EINSTEIN et les travaux d'EMILE MEYERSON (Voir *Isis*, II, 149-50 ; 12, 414 ; et aussi : 7, 317 ; 9, 192 ; 11, 199, 211, 527).

En 1929 ont été récompensés les « Essais sur l'histoire de la balistique », 334 p., Paris, Soc. d'édit. géograph., maritimes et coloniales, 1928, de Mr. PROSPER ELIE CHARBONNIER, inspecteur général de l'artillerie navale, dont un compte-rendu paraîtra dans un fasc. prochain. L. G.

2. Queries and Answers.

Query 16. Jorach (or Yôrâh), unknown author of a book on animals.—ALBERT THE GREAT in his *De animalibus* quotes twelve times one JORACH, whom I have not been able to identify. I have checked

(1) J. PELSENEER : Une lettre inédité de NEWTON (*Isis*, 12, 237-54, 1929); Une opinion inédite de NEWTON sur l'analyse des anciens à propos de l'*Analysis geometrica de* HUGO DE OMERIQUE (*Isis*, 14, 155-65, 1930).

all the quotations in HERMANN STADLER's admirable edition. The only ones from which any information on this JORACH can be obtained are the following :

Analopos, ut in libro suo de animalibus dicit JORACH, animal est acutis cornibus (XXII, 16).

Sed iste JORACH frequenter mentitur (XXII, 106).

SOLINUS et JORACH de membris loquentes animalium (XXIII, 19).

Caristae sunt aves, ut dicunt SOLINUS et JORACH, quae innocue flammis involant ita quod nec pennis nec corpore aduruntur, sed illi philosophi multa mentiuntur, et puto quod et hoc sit unum de mendaciis eorum (XXIII, 34).

In another quotation (XXV, 30), JORACH's name is bracketed with PLINY's.

Hence according to ALBERT THE GREAT, JORACH wrote a book on animals and told many lies.

From LYNN THORNDIKE's *History of magic* (vol. 2, 404, 423, 431, 1923) I gather that the same JORACH or JORATH was also quoted by ARNOLD THE SAXON and BARTHOLOMEW THE ENGLISHMAN. See also VALENTIN ROSE : ARISTOTELES de lapidibus und ARNOLDUS SAXO (*Z. f. deutsches Alterthum*, vol. 18, 321-455, 1875).

In M. STEINSCHNEIDER's *Hebräische Übersetzungen* (1893, p. 55, note 67) the name JORACH is bracketed with that of PHORON and in G. LIBRI's *Histoire des sciences mathématiques en Italie* (vol. 1, 244, 1838) I find a reference to an Arabic MS. « PHORON CHALDAEUS de animalibus » (?). That curious coincidence led me nowhere.

The name JORACH is certainly Semitic. I never came across it in Arabic or Syriac, but it occurs in Hebrew. See EZRA II, 18 « The children of JORAH, an hundred and twelve ». (The Hebrew, according to our transliteration, reads YÔRÂH). Thus this unknown JORACH or YÔRÂH was probably a Jew. G. S.

Reviews

Âryabhaṭa.—*The Âryabhaṭîya of Âryabhaṭa.* An ancient Indian work on mathematics and astronomy. Translated with notes by WALTER EUGENE CLARK. XXX+90 p. Chicago, University of Chicago Press, 1930 ($ 2.50).

Says the translator, professor of Sanskrit in Harvard University : « The present translation, with its brief notes, makes no pretense at completeness. It is a preliminary study based on inadequate material. Of several passages no translation has been given or only a tentative translation has been suggested. A year's work in India with unpublished manuscript material and the help of competent pundits would be required for the production of an adequate translation. I have thought it better to publish the material as it is rather than to postpone publication for an indefinite period. The present translation will have served its purpose if it succeeds in attracting the attention of Indian scholars to the problem, arousing criticism, and encouraging them to make available more adequate manuscript material. » The translation and annotation seem to have been done with considerable care and will be very useful for western readers, but they were hardly needed to attract the attention of Hindu scholars, for the latter have always paid considerable attention to ÂRYABHAṬA. I do not say that the Hindu studies on the subject were final or sufficient, but it is not fair to imply that the Hindus had neglected it. Many Hindu publications by PRABODH CHANDRA SENGUPTA, BIBHUTIBHUSAN DATTA, and SÂRADÂKÂNTA GÂNGULI, not to speak of others, have been reviewed in *Isis*. Moreover SENGUPTA published an English translation of the *Âryabhaṭîya* in Calcutta, 1927 (*Isis*, 13, 148). CLARK knew of it when his own translation was completed but before its actual publication. If he could refer to it in a P. S. (p. XVII), he could just as well have analyzed it and added an appendix discussing it. His own publication would have been more valuable. As it is, his cryptic reference to SENGUPTA's earlier translation will allure critical readers ; they will want to find out for themselves how the two translations and commentaries compare, and CLARK's cavalier treatment of his predecessor —an authority on Hindu mathematics—will prejudice them against him.

If the present translator failed to complete his own task by a fuller consideration of the previous English translation—and this would have been relatively easy for him—the reviewer may be excused from attempting the necessary comparison and discussion. CLARK's preface is a summary of the history of the subject, but perhaps a little too condensed. We would have liked him to go a little more deeply into the subject. For example, with regard to the problem of the two or three ĀRYABHAṬA he refers the reader to KAYE's and DATTA's memoirs. It is hoped that this very hansdome edition of an early classic will attract the attention, not only of Hindu, but of Western scholars, on Hindu mathematics. G. S.

Ettore Verga. — *Raccolta Vinciana.* Fascicolo XIII, 1926-1929. XXIV+299 p., 18 fig. Milano, Castello Sforzesco, 1930. (Lire 40) Supplemento al fasc. XIII, Raccolta Vinciana. 13 p., Ibidem, 1930.

Dr. VERGA may well be proud of the magnificent monument which he had built largely with his own indefatigable hands to the glory of LEONARDO DA VINCI. The thirteen volumes of his *Raccolta* represent the patient and splendid effort of twenty-five years. Neither he nor his *Raccolta* are unknown to our readers for we have spoken of him a great many times, and the volumes of the *Raccolta* have been reviewed as they appeared, the ninth and tenth in our vol. 3, 104, 331 ; the eleventh, in vol. 5, 506 ; the twelfth in vol. 9, 156.

The present volume contains as usual a whole series of articles, some of them illustrated, in Italian and German. Most of them are devoted to artistic and biographical considerations ; two to scientific topics : ROBERTO MARCOLONGO on the center of gravity of solids in LEONARDO's writings (p. 99-114) ; EMIL MÖLLER, on anatomical drawings in the museum of Weimar. (in the supplement, 13 p.) This is followed by a long series of reviews some of them very long, and almost all written by VERGA himself (p. 133-273), and finally by various shorter notes relative to Leonardian events of various kinds (p. 273-94).

The items of scientific interest are briefly mentioned in our twenty-ninth critical bibliography.

May Dr. VERGA be granted to continue his invaluable *Raccolta*—the collection and its bulletin—for many years to come. G. S.

Robert Theodore Gunther.— *Early Science in Oxford*, vol. VI, The Life and Work of ROBERT HOOKE (part I) : XXIV+396 p. ; vol. VII, The Life and Work of ROBERT HOOKE (part II) : VIII+pp. 397-806. Oxford, Oxford University Press, 1930 ; one and a half guineas each volume.

« ROBERT HOOKE was one of the most brilliant of that illustrious band

of Oxford men of science who took part in the really great Oxford Movement, which resulted in the foundation of the Royal Society, and in establishing its prestige. All his work is characterized by pre-eminent sanity and utility. His many discoveries and inventions were of the greatest interest to his contemporaries both in Oxford and in London, and have now become so essential a part of modern civilization that we whose lives are regulated by those inventions, are in danger of forgetting the inventor (Preface, p. VII)... Had he been a countryman of GALILEO or GOETHE, the whole world would now be ringing with his fame (p. VIII)... He was perhaps the most outstanding figure in the Royal Society (p. XIV) ». « J'avais d'abord l'intention de le passer sous silence (il le méritait bien, pour avoir fait tant de bruit de son vivant), mais les éloges que lui prodigue POGGENDORFF m'ont forcé la main. » (M. MARIE, *Hist. des sc. mathématiques*, t. 5, p. 117, 1884).

Il faut avouer que la figure si intéressante de HOOKE demeure encore une énigme pour les historiens de la science. Depuis plus de deux siècles déjà que WALLER publia en tête de son édition des Œuvres Posthumes (1705) une Vie de l'auteur de la Micrographie, rien de nouveau n'a été dit sur le savant dont l'imagination semble ne pas avoir été moins fertile que celle de NEWTON. Aucune étude d'ensemble n'a été esquissée. Des documents d'une très grande importance sont toujours inédits, savoir : 1) les nombreux manuscrits qui sont conservés à la bibliothèque de la Royal Society ; 2) le *diary* de HOOKE. Ce journal, que j'ai été le premier à signaler (*Isis*, 12, 237-254) couvre une période de onze années (1671/2-1683). Je lui consacre un article ici-même et l'édition critique que Mr. ADAMS, de University College, Londres, et moi-même nous espérons pouvoir être bientôt autorisés à donner de ce volumineux manuscrit constituera, pensons-nous, une intéressante contribution à l'étude de la science anglaise. Ce *diary* prolonge celui de PEPYS et a l'avantage de nous fournir dans le domaine scientifique des renseignements absolument nouveaux en très grande abondance. Dans l'édition projetée, nous comptons inclure également 3) le *diary*, faussement attribué à J. PETIVER, trouvé en 1929 par Mr. H. W. ROBINSON au British Museum (Sloane Ms. 4024). Ce n'est pas, comme le manuscrit du Guildhall, un journal régulièrement tenu, mais un assemblage de 194 petits feuillets détachés et en mauvais état qui, mis soigneusement en ordre par Mr. ROBINSON, ont montré qu'ils se rapportaient à deux périodes distinctes : 1688-1689/90 et 1692-1693.

On voit que presque tout reste à faire en ce qui concerne HOOKE et que vouloir dès à présent dresser le bilan de son œuvre scientifique serait prématuré. Aussi ne saurait-on témoigner assez de reconnaissance à Mr. R. T. GUNTHER pour l'œuvre qu'il nous donne aujourd'hui. L'érudit

auteur à qui, dans le domaine de l'histoire des sciences entre autres, nous sommes redevables d'un si grand nombre de belles et précieuses publications, vient d'ajouter deux volumes nouveaux à sa monumentale étude : *Early Science in Oxford* (*Isis*, 14, 233-235). Mr. GUNTHER a eu l'heureuse idée — et la patience — de mettre sous forme chronologique les témoignages divers que l'on possède de l'activité si dispersée de HOOKE : « With the express object of focusing attention upon his remarkable achievements, we have collected all readily available notes on his various activities in the following pages » (Preface, p. XVI). Et peut-être ne pouvait-on mieux inaugurer la série des travaux qui, souhaitons-le, verront le jour bientôt à l'occasion du prochain tricentenaire de HOOKE (1935) que par ce premier travail d'approche qui montre de façon frappante combien cet animateur merveilleux — dont l'attention s'éparpillait dans des domaines si variés et dont la compétence quasi-universelle se contentait peut-être trop facilement d'esquisses et de suggestions — révéla plus de brillant que de profondeur et de persévérance. « To show the diversity of his work is one of the objects of these volumes » (p. XII).

Mr. GUNTHER commence par nous donner la biographie due à WALLER, en y ajoutant des extraits des « *Vie de Hooke* » écrites par WARD et AUBREY. Nous suivons ensuite HOOKE dans sa carrière scientifique, depuis ses débuts, à vingt ans (1655) jusqu'à sa mort. Quels sont les matériaux rassemblés par Mr. GUNTHER ? « Where no other acknowledgment is made, the facts now published have been mainly derived from BIRCH's *History of the Royal Society*, and from DERHAM's *Philosophical Experiments and Observations*. They should, of course, be collated with all manuscript materials still extant » (p. XIX). C'est dire que les textes dûs à HOOKE lui-même occupent relativement peu de place dans les quelques huit cents pages que comportent ces deux volumes. Il eût été sans doute trop long de reproduire, par exemple, les mémoires insérés dans les *Philosophical Transactions*, et il suffira que l'on en trouve les références. Mais encore aurait-il fallu qu'un catalogue détaillé, composé surtout en vue de faciliter le travail des chercheurs et des érudits, fût — dans la mesure du possible — complet. Or, de regrettables omissions se constatent dans le tableau chronologique qui nous est offert, où l'on s'étonne, d'ailleurs, de trouver si peu de notes critiques ; c'est ainsi que les admirables lettres à NEWTON (1679-80) relatives à la déviation des graves ne sont mentionnées que indirectement et le lecteur non averti aurait quelque peine à en retrouver le texte (ROUSE BALL, *an Essay on Newton's Principia*, 1893, pp. 139-153). L'oubli est d'autant plus curieux que l'on trouve (p. 714) à la date du 15 septembre 1689 la lettre de J. AUBREY à A. WOOD qui se réfère à cette correspondance entre HOOKE et NEWTON. On eût aimé aussi avoir une liste exacte des inédits, qui semblent au

surplus peu nombreux et fournis presque tous par le manuscrit (cf. p. 577) du British Museum Sloane 1039 dont Mr. GUNTHER ne publie apparemment que les fragments principaux. Il y a d'abondantes illustrations, empruntées en grande partie aux *Philosophical Collections* (1679-1682) dont HOOKE fut l'éditeur, mais comme on pouvait s'y attendre, aucune ne le représente, et il est vraisemblable que ses traits nous demeureront à jamais inconnus. Il faut déplorer que l'index (à la fin du second volume) soit si incomplet ; c'est là un grave défaut pour un ouvrage destiné surtout à être consulté.

JEAN PELSENEER.

Pierre Brunet. — MAUPERTUIS. I. *Etude biographique* (111 p.). II. *L'œuvre et sa place dans la pensée scientifique et philosophique du XVIII^e siècle.* (487+VI p.). Paris. ALBERT BLANCHARD, 1929.

Le nom de MAUPERTUIS a échappé à l'oubli ; il reste attaché pour tous ceux qui ont reçu une bonne culture scientifique au *principe de la moindre action;* cependant si le nom est connu, la vie si intéressante de ce grand savant du 18^e siècle, qui fut ami intime, puis ennemi de VOLTAIRE, qui malgré sa réussite en France alla vivre chez FRÉDÉRIC LE GRAND et organisa l'académie de Berlin n'a jusqu'à présent que peu suscité la curiosité ; de même que son œuvre si variée dont les diverses parties sont consacrées aux problèmes scientifiques qui étaient alors de brûlante actualité ; cette œuvre a une grande valeur ; de plus, elle est représentative de son temps, et elle nous permet de pénétrer dans la mentalité d'une époque heureuse où le désir ardent et sincère de s'instruire, de comprendre, de tout savoir, servait de moteur à une intelligence surexcitée et active qui s'efforçait de mettre à nu les secrets que la Nature semblait disputer jalousement aux recherches passionnées des travailleurs.

Il nous faut donc remercier M. BRUNET qui dans deux volumes, l'un assez court consacré à la biographie de PIERRE LOUIS MOREAU DE MAUPERTUIS (Saint-Malo 1698 — Bâle 1759) l'autre plus long destiné à nous faire connaître le savant, et le philosophe qu'était MAUPERTUIS, a attiré et satisfait notre curiosité en ce qui concerne ce grand homme.

Nous n'allons pas ici, faute de place insister longuement sur les péripéties diverses de la vie de MAUPERTUIS, dont M. BRUNET sut faire un récit intéressant et animé ; signalons seulement qu'en dehors des années de jeunesse, où la recherche d'une situation sociale le fit entrer dans l'armée (dans un régiment de mousquetaires d'abord, puis dans la cavalerie) toute sa vie fut consacrée à la recherche scientifique ; les faits remarquables de cette vie, son voyage en Laponie pour préciser la forme de la terre, ses relations amicales ou inamicales avec Mme DU CHATELET, son séjour à Bâle, à Vienne, son installation en Prusse où

il réorganisa l'académie de Berlin, ce qui lui apporta, outre de grandes satisfactions, la douleur de se brouiller avec de vieux amis tels que KOENIG et VOLTAIRE, ses autres polémiques elles-mêmes sont des épisodes de sa carrière de savant. De son mariage heureux, il n'y a rien à dire, non plus que de ses voyages à Saint-Malo où il eut parfois le plaisir, en se reposant d'une activité débordante, de respirer l'air de sa ville natale, de revoir la petite patrie où les personnes d'âge mûr ont tant de joie à revivre leurs souvenirs d'enfance. Remarquons pourtant ici que la théorie des milieux que TAINE a appliquée souvent avec tant de bonheur semble en défaut au sujet de MAUPERTUIS ; du moins l'on ne trouve ni dans son caractère ni dans ses œuvres, l'influence de la terre bretonne, ou de la mer bretonne que l'on met si facilement en évidence dans la personnalité et les écrits de son illustre concitoyen CHATEAUBRIAND.

Il nous faut maintenant, en compagnie de M. BRUNET jeter un coup d'œil panoramique sur l'œuvre scientifique de MAUPERTUIS ! Quelle variété dans les questions envisagées, quelle exubérance de pensée ! Il a longuement étudié les mathématiques, et a apporté à la connaissance des courbes qui alors attiraient l'attention des savants, quelques matériaux précieux. Il a été un des premiers savants qui ont exposé en France les résultats de l'œuvre de NEWTON et qui ont tenté de les appliquer au monde stellaire, à l'explication du mouvement des comètes par exemple, ainsi qu'à d'autres phénomènes astronomiques qu'il serait trop long d'énumérer. Il a consacré une partie de son activité à étudier la figure de la Terre qui préoccupait alors astronomes et géographes ; ce qui lui a fourni l'occasion de nombreux voyages et a provoqué des polémiques avec les CASSINI qui étaient eux aussi de grands savants. Il poussa loin ses travaux concernant la physique et la mécanique ; signalons pour mémoire ses écrits sur *la moindre action* qui ont fait alors sa réputation universelle et que M. BRUNET étudie longuement ; signalons encore qu'il publia quelques travaux concernant l'optique et l'acoustique. MAUPERTUIS fut aussi un naturaliste fort distingué ; sa *Vénus physique* dans laquelle il expose et discute longuement les théories concernant la génération des animaux qui suscitaient alors curiosités et découvertes est d'un intérêt captivant ; ainsi que ses hypothèses et ses recherches concernant la tératologie. Il introduisit sinon le Newtonianisme rigide du moins une sorte d'attraction élective dans l'explication des phénomènes biologiques et par là crut rendre clairement compte de la formation régulière et de l'accroissement des êtres vivants ; ses travaux eurent sur BUFFON une influence indéniable.

Comme tous les savants de son temps, MAUPERTUIS fut un philosophe ; du moins, dans ses divers ouvrages, il examina attentivement plusieurs problèmes fort importants : nous laisserons de côté ses travaux de théologie

naturelle qui semblent en dehors de la science ; signalons pourtant que le principe de la moindre action lui paraissait prouver d'une excellente manière l'existence et la sagesse de l'être suprême ; nous laisserons de côté comme tout-à-fait étrangers à la science son *essai de philosophie morale* qui base,comme il était alors de mode,sur l'aspiration au bonheur, l'ensemble des règles de conduite que nous devons observer. Nous parlerons plus longuement de ses recherches sur la théorie de la connaissance scientifique et notamment du rôle attribué à l'expérience et au raisonnement dans l'élaboration de la science. En fidèle Newtonien MAUPERTUIS était ennemi des systèmes *à priori;* il croyait l'expérimentation nécessaire non seulement pour fournir le point de départ des généralisations du savant qui utilise les faits pour construire une théorie, mais encore pour le guider,pour l'obliger à des vérifications continuelles,et par là empêcher son esprit de s'égarer dans des déductions lointaines et aventureuses ! De même s'il ne proclame pas absurde la possibilité de connaître les causes de la pesanteur, il ne croit pas que cette cause vienne se révéler au chercheur et conseille à celui-ci d'étudier attentivement ses effets et ses conséquences. MAUPERTUIS, par ailleurs attache une grande valeur d'inspiration au raisonnement par analogie, et exprime par cette phrase (que nous aimons à citer comme échantillon de son style élégant sur lequel M. BRUNET a oublié d'attirer l'attention) et sa force et sa faiblesse. « L'analogie nous délivre de la peine d'imaginer des choses nouvelles et d'une peine encore plus grande qui est de demeurer dans l'incertitude ; elle plaît à notre esprit ; mais plaît-elle à la Nature ? »

L'ouvrage de M. BRUNET se termine par une liste des travaux de MAUPERTUIS, et par une bibliographie des ouvrages cités, qui peut aider l'historien des sciences au XVIII^e^ siècle à trouver un grand nombre de documents intéressants.

(Paris) HÉLÈNE METZGER.

Paul Tannery (1843-1904). -- *Pour l'histoire de la science hellène. De Thalès à Empédocle.* 2^e^ éd., par A. DIÈS, avec une préface de FR. ENRIQUES. XXII+436 p., 1 portr. GAUTHIER-VILARS, 1930.

Depuis longtemps épuisée, cette histoire des pionniers de la science, écrite par TANNERY de 1877 à 1887, manquait aux travailleurs, étudiants ou professeurs, aux amis de l'humanisme large, tel que le conçoit G. SARTON. Sa réimpression était annoncée depuis plusieurs années, et F. ENRIQUES avait publié dès 1924 (*Rev. de mor. et de métaphys.* 31, 425-34 ; *Isis*, 7, 335) la préface de cette nouvelle édition. Je note à ce sujet que l'éditeur aurait pu se permettre de modifier légèrement le texte d'une note de cette préface où ENRIQUES annonçait la traduction française de son ouvrage : *Per la storia della logica;* cette traduction est en effet

parue depuis 1926 sous le titre : *l'évolution de la logique* (Paris, CHIRON, et non pas CHÉRON ; *Isis*, 5, 469 ; 9, 566).

DIÈS, que MADAME PAUL TANNERY a chargé de rééditer cette partie de l'œuvre de son mari, s'en est tenu, avec raison, au respect absolu du texte de la 1e édition ; les corrections que TANNERY avait portées, deci delà, sur son exemplaire de main, sont simplement citées entre crochets, au bas des pages. Pour la traduction des textes doxographiques et des fragments dont TANNERY avait fait suivre chacune de ses monographies, DIÈS donne, toujours entre crochets, la référence à la 3e édition des *Fragmente der Vorsokratiker* et aux *Nachträge* qui leur font suite, de H. DIELS, que TANNERY aurait certainement utilisés s'il en avait eu la possibilité. Enfin, pour permettre au lecteur de suivre le travail qui s'est fait depuis la publication de l'ouvrage de TANNERY, DIÈS a ajouté à la fin du volume une bibliographie, très bien faite, et divisée de façon à correspondre autant que possible aux chapitres successifs du livre ; naturellement, les travaux de TANNERY postérieurs à la 1e édition sont d'abord cités, bien qu'ils soient déjà signalés, en notes courantes, entre crochets, à l'intérieur du volume.

Quel est donc le contenu de ce livre qui fit, à son apparition, l'effet d'une révolution, tant il renversait de vieilles idées, tant il contrariait les traditions des historiens de la philosophie. L'introduction de TANNERY et les deux premiers chapitres sont consacrés à la méthode que suivra l'auteur, aux sources et à la chronologie (53 p.). Viennent ensuite des études sur THALÈS (54-83), ANAXIMANDRE (84-122), XÉNOPHANE (123-49), ANAXIMÈNE (150-71), HÉRACLITE (172-205), HIPPASOS et ALCMÉON (206-24), PARMÉNIDE (225-54), ZÉNON (255-70), MÉLISSOS (271-83), ANAXAGORE (284-312), EMPÉDOCLE (315-47). En appendice (348-414), traduction du fragment de THÉOPHRASTE sur les sensations, note sur l'arithmétique pythagoricienne, et enfin deux comptes rendus de TANNERY à propos de MÉLISSOS, qui ne figuraient pas dans la 1e édition, et une lettre à GASTON MILHAUD à propos de l'*ἄπειρον* chez ANAXIMANDRE, PYTHAGORE, XÉNOPHANE, MÉLISSOS et ARISTOTE.

Avec la *Géométrie grecque* (GAUTHIER-VILLARS, 1887) et les douze volumes de travaux réunis sous le titre général de *Mémoires scientifiques* (*Isis*, 14,426-30), dont restent à paraître le t. X, actuellement sous presse qui contiendra tous les comptes rendus de TANNERY, et les t. XI et XII réservés à la correspondance scientifique, toute l'œuvre de TANNERY sera enfin accessible à tous, avec « sa jeunesse, sa clarté conquérante et ses vertus d'initiation spirituelle » (A. DIÈS).

Je signale en terminant la thèse de doctorat soutenue par J. NUSSBAUM devant l'université de Lausanne en 1929 sous le titre : *Paul Tannery et l'histoire des physiologues milésiens* (*Isis*, No 46). L. G.

Immanuel Löw. — ***Die Flora der Juden, Band I, Erste Hälfte : Kryptogamae. Acanthaceae — Composaceae. — Zweite Hälfte : Convolvulaceae — Graminaceae.*** Veröffentlichungen der ALEXANDER KOHUT Memorial Foundation, Band IV. XIV + 807 S. Wien, Emil Damask, 1926 und 1928.

Die Flora der Juden, IMMANUEL LÖWS Lebenswerk, liegt nunmehr — abgesehen von einem noch zu erwartenden Registerband — vollendet vor. (1) So wird es selbstverständliche Pflicht, nicht nur die beiden neuen Halbbände zu besprechen, sondern die einzig dastehende Gelehrtenarbeit, die in diesem Werke zusammengedrängt ist, noch einmal im Ganzen zu überschauen.

Der Verfasser hat in dem Werk, das aus den 1881 erschienenen '*Aramäischen Pflanzennamen*' hervorgegangen ist, einen unendlichen Reichtum von neuen Quellen erschlossen. Die Geschichte aller Gewächse, die als Nutz- und Nährpflanzen, als Gewürze, Arzneipflanzen, Blumen oder Unkräuter irgendwo im Bereich des Judentums Bedeutung erlangt haben, ist von den ältesten literarischen, archäologischen, kunstgeschichtlichen Dokumenten aus über das ganze hebräische Schrifttum und die sonst von Juden herrührende Literatur bis zur Gegenwart durchgeführt. Um diesen Kern legt sich von der philologischen Seite her der ganze Überlieferungsstoff des klassischen Altertums und der islamischen Wissenschaft, von der naturwissenschaftlichen das Ergebnis der pflanzengeographischen und floristischen Forschung der letzten Jahrhunderte. Doch selbst mit dieser ungeheuren Ausdehnung der benützten Quellen hat sich der gelehrte Verfasser nicht begnügt : auch die schöne Literatur, die Geschichte und das Folklore aller Zeiten und Völker hat ihm Beiträge geliefert, und auf Schritt und Tritt begegnet man persönlichen Auskünften und Mitteilungen von Orientalisten, Historikern, Geographen, Reisenden und Naturforschern. So ist ein in der Literatur einzig dastehendes Werk entstanden, in dem jeder Leser, der sich für die Geschichte der Pflanzenwelt des vordern Orients interessiert, eine Fülle von Aufschlüssen findet, das aber ganz besonders für den Historiker der Naturwissenschaft des Altertums und Mittelalters eine unerschöpfliche Fundgrube von Tatsachen und Dokumenten darstellt.

Um den riesigen Stoff zu gliedern, hat LÖW die natürlichen Pflanzenfamilien alphabetisch geordnet aufeinander folgen lassen und den Phanerogamen ein — begreiflicherweise kurzes — Kapitel über Kryptogamen vorausgeschickt. Für einen an die systematische Gliederung der Florenwerke gewöhnten Botaniker entsteht daraus eine gewisse Unruhe, für die Mehrzahl der Leser wird die alphabetische Anordnung, die auch

(1) Band II erschien in 1924 (*Isis*, 6, 428-29); Band III, in 1925 (*Isis*, 8, 210-11).

innerhalb der Gattungen und Arten durchgeführt ist, die bequemste sein. Wer nicht irgendwie schon botanische Kenntnisse besitzt, wird das Buch ja doch kaum in Gebrauch nehmen ; auch werden die Register, die den Schlussband bilden sollen, jede Pflanzenart, jeden Namen und jedes Sonderthema mit Leichtigkeit auffinden lassen.

Es entspricht den grossen Unterschieden im Gebrauchswert der Pflanzenarten, dass auch die ihnen in der Flora gewidmeten Kapitel nach Umfang und Behandlungsweise die grössten Gegensätze aufweisen. Die rein floristischen Angaben, vor allem die Kapitel über arabische Pflanzennamen, sind summarisch behandelt. Sobald Anwendungen, besonders medizinischer Art, in Frage kommen, wird die ganze griechische, syrische, arabische und hebräische Literatur beigezogen und kritisch beleuchtet. Den Kulturpflanzen im engeren Sinne sind Monographien gewidmet, die alle erreichbaren Nachrichten zu Meisterstücken pflanzengeschichtlicher Darstellung zusammenfassen.

Um aus den zur Besprechung stehenden Bänden einiges, nur das allerwichtigste, herauszugreifen, so findet man bei den Kryptogamen interessante Mitteilungen über Orseille, Mannaflechte, Trüffel und Schachtelhalme. Als ein Buch für sich kann die Behandlung von Weinbau und Wein gelten (S. 48-189 !). Von den Anacardiaceen sind Terebinthe, Mastixstrauch, Pietazie und Sumach eingehender besprochen, von den Apocynaceen der Oleander. Dann folgt ein grosses Kapitel über die Feige (S. 224-254) und kleinere über Maulbeere, Sykomore, Hanf und Hopfen. Die Balsamstaude, Myrrhe und Weihrauch finden ihrer kultischen Bedeutung entsprechende Behandlung (S. 299-315), der Kappernstrauch als eine der kennzeichnendsten wilden Schlingpflanzen des Gebiets bietet auch kultgeschichtlich und medizinisch reichen Stoff (S. 322-331). Aus dem zweiten Halbband erwähne ich den Waid, die Kressearten, den Meerrettich, den Rettich und den Senf, die Kürbisse, Melonen und Gurken, den Rizinus und andere Euphorbiaceen, die Seifenpflanzen, die Papyrusstaude, das Schilfrohr, das Zuckerrohr und vor allem die kritische Behandlung der Getreide- und Futtergräser (S. 686-807). Auch wenn ich die Zahl der Beispiele verdoppeln oder verdreifachen könnte, würden sie kein Bild von dem Reichtum und der Mannigfaltigkeit des bearbeiteten Stoffes geben. Wenn aber e i n e Seite des Buches noch besondere Hervorhebung verdient, so ist es die kritische Sichtung der Pflanzennamen, die ebenso viel Literatur- wie Sachkenntnis erfordert und in vorbildlicher Weise durchgeführt ist.

Exegi monumentum aere perennius — so darf der greise Verfasser mit Recht von sich sagen. Der Dank aller Gelehrten, die seine Riesenleistung zu würdigen wissen, wird ihm für alle Zeiten gesichert sein !

(*Berlin*) JULIUS RUSKA.

Angel González Palencia. — *Los Mozárabes de Toledo en los siglos XII y XIII.* Cuatro volúmenes en folio. Volumen preliminar, Estudio e indices, XVI+461 p., 1930; vol. 1, Documentos números 1-382. VIII+324 p., 1926; vol. 2, Documentos números 383-726. 341 p., 1926; vol. 3, Documentos números 727-1151. 595 p., 1928. Madrid, Instituto de Valencia de Don Juan, 1926-1930 (150 pesetas).

The history of mediaeval Spain is of immense interest because it was in that country that the cultural exchanges between Islâm and Christendom took place with the greatest frequency and intensity. To be sure Muslim lore and Muslim manners reached western Europe through other intermediaries, e.g., through Sicilians, Genoese, Venetians, and returning Crusaders, but all those importations were insignificant as compared with the continuous diffusion which lasted in Spain for many centuries. (1) Islâm penetrated Christendom not through the Near East, as is so often said, but through the Far West! There indeed were the self-same territories conquered and reconquered by Muslim and Christian princes. When the Christians were in power a certain number of Muslims would be more or less assimilated, the so-called Mudejars. On the contrary when the Muslims had the upper hand some Christians without abandoning their religion would adopt the conquerors's customs and language. These were the socalled Mozarabs. Both names have remained in the language of educated people all over the world, for one often speaks of Mozarabic liturgy—the ancient liturgy of the Christians of Toledo—and of Mudejar architecture—the architecture created by Muslim artisans working under Christian patronage.

It is clear that the Spanish-Arabic culture can best be studied by Spanish scholars, and these have fully risen to their opportunity, as our readers well know. How often have we not been obliged to mention the illustrious names of FRANCISCO CODERA Y ZAIDIN, JULIÁN RIBERA Y TARRAGÓ, MIGUEL ASÍN Y PALACIOS, among others? (1) Now to these names must be added that of their leading disciple, the author of the imposing work under review.

There have been preserved in the archives of the cathedral of Toledo for centuries a quantity of Mozarabic documents. A few of these were translated in the course of time, the earliest in 1607 by MIGUEL DE LUNA of Granada, others in the seventeenth and eighteenth century, the translations becoming poorer and poorer, as the ignorance of Arabic increased. The existence of these documents was also pointed out by the Jesuit JUAN ANDRÉS in his history of comparative literature (Italian edition,

(1) For other reflexions on the same subject, see *Isis*, 10, 67, 1928.
(1) See, e.g., vol. 12, 161-63.

1782-98 ; Spanish translation, 1784-1806). Thanks to the indefatigable industry of Professor GONZÁLEZ we are now given for the first time a complete and splendid edition of all of these documents, provided with translations, notes, a long introduction, and generous indices.

But before dealing with the edition, it may be well to speak a little longer of the documents themselves. They enable us to have a more definite idea of the Mozarabic culture of Toledo. As said above the Mozarabs were Arabicized Christians. The name comes from the Arabic muta'arrib or musta'rib, the active participles of the fifth and tenth stems of the verb 'aruba, to be a genuine Arab. The very existence, prosperity, and persistency of the Mozarabs prove at once Muslim toleration of the Christians and Christian toleration of Arabic manners. The archbishopric of Toledo continued to exist during the Muslim period, and this allowed the development of the Mozarabic community. After the conquest of Toledo in 1085 by ALFONSO VI that community persisted in its Arabic ways, and continued to use the Arabic language. Of course many of these Mozarabs were bilingual, but throughout the twelfth century the Arabic language predominated ; during the thirteenth century the Castilian became gradually more important, yet Arabic was still spoken and written by them in the fourteenth century. The Mozarabic documents edited by Don ANGEL range from 1083 to 1315. How shall we account for the loyalty of those Christians to the Arabic language and culture in the midst of a Christian kingdom? The explanation is I believe double, first, the inertia of language, second, the superiority of the Arabic culture, superiority which the Christians of the thirteenth century readily admitted. Says the author (p. 118) :

« Creo que una de las consecuencias más útiles de la publicación de esta colección de documentos será que los doctos puedan comprobar el grado de islamización en los cristianos toledanos, que, sin embargo, les permite seguir profesando su religión. No habrá, pues, que atribuir a presión política la afición que los mozárabes mostraron a la lengua árabe, sino que se habrá de explicar por la ley inexorable en el desarrollo de la humanidad de que la civilización más fuerte domina sobre la más débil : *Graecia capta...* »

The main point to remember is that there was in Spain and particularly in Toledo between the Christian and Muslim cultures a real anastomosis of which the Mozarabs were one of the chief organs. Thus every thing concerning them is of deep interest to the student of the history of science and civilization, even if the purely scientific achievements of these Mozarabs were negligible, as was unfortunately the case.

To return to the present edition, its preparation goes back almost to the organization of the Toledan archives in the seventies of last century.

FRANCISCO SIMONET made a special study of the Mozarabic documents, witness his *Glosario de voces latinas e ibéricas usadas por los mozárabes españoles* (Madrid, 1888). Later they were investigated and catalogued by FRANCISCO PONS BOIGUES (well-known by his *Ensayo bio-bibliográfico sobre los historiadores y geógrafos arabigo-españoles*, Madrid, 1898) and by LUIS GONZALVO Y PARÍS, and finally by the author, who devoted much time to them, off and on, for more than fifteen years.

There are altogether 1151 documents, all of them in Arabic. The Arabic text of each is given together with a Spanish translation and brief notes. The basmala and doxology are omitted, and stereotyped formulas are printed once for all, then represented by a number whenever they reoccur.

Practically all these documents are on parchment, very few on paper. The earliest paper one is dated 1166 (no. 80). For the sake of comparison, I may recall that the earliest paper MS. of Spain is the *Breviarium gothicum sive mozarabicum* of Silos abbey, dating from the eleventh century and the next ones date already of the thirteenth century. I may recall also that paper was manufactured in Morocco about 1100 and in Spain about 1150 ; judging from the documents of the twelfth and thirteenth centuries, it must have remained relatively rare until the thirteenth and fourteenth centuries. (1)

The writing is Arabic except for twenty of them written in Hebrew script (but in Arabic language). The signatures are in Arabic, Latin or rabbinical script. The very earliest document is dated in the Muslim fashion (no. 1, Ramaḍân 475 = Jan./Febr. 1083) ; all others, according to the Spanish era, târîkh al-ṣafr, beginning on Jan. 1, 38 B.C. (that is, we must subtract 38 from the Spanish date to obtain our own).

The numeration is very curious, the numerals used being very different from the Arabic ; e.g., 1 is like a small delta, 7 like our 7, 9 like our 8, 30 like a Greek mu, 70 like an Arabic 5, 300 like our t, 4000 like our s, the fraction one third like the Arabic 7. See table on p. 48 of the preliminary volume.

It is typical that many Mozarabs had a double name, the one Arabic, the other Latin or Spanish. E.g., CLEMENS FILIUS JOHANNIS = IBN 'ABD AL-'AZÎZ AL-HAMAMÎ ; DOMINGO SEBASTIÁN = 'UMAR ; the priest mair PETRUS = 'ABD AL-'AZÎZ IBN SUHAIL. The same thing occurs in Latin documents, e.g., in one of 1115 (p. 123) : « In Dei nomine

(1) G. SARTON : *Introduction to the history of science* (vol. 1, 782, 1927), with reference to another Spanish MS., the *Glossarium latino-arabicum* of Leiden, dating probably of the eleventh century, written partly on parchment and partly on paper.

ego DOMINICO PETRIZ, qui ita uocor in latinitate et in algariua AUOLFAÇAN AUENBAÇO ; similiter et ego DOMINIQUIZ, qui ita uocor in latinitate et in arabia AULFACAM AUENCELEMA, una pariter cum uxores nostras COLUMBA et LEOCADIA, uendimus una uinea que habemus in Monte Aurio a tibi magistro PETRUS, gramatico ecclesie Sancte Marie de Toleto... » It is clear that the Latin name was more formal, a sort of official name reserved for special occasions, the Arabic one being more familiar, the one used every day. It is also clear that Latin was not their usual language, witness this execrable specimen. The study of the Arabic names is especially interesting ; as they give the individual's genealogy, they enable one to see when the Arabicization began, e.g., 'UMAR IBN YAḤYÂ IBN GAUDIUS. GAUDIUS was a pure Christian, his son and grandson, Mozarabs.

Outside of the Mozarabs there were also established in Toledo a large number of Jews, who were probably trilingual, some Muslims, and an important French colony, descendants of the Francos who had helped ALFONSO VI in the reconquest. A special ward of the city, the Arrabal de Francos, was assigned to them.

DON ANGEL's work is arranged as follows : three volumes contain the documents themselves, a fourth one is devoted to their study and the indices. The documents are divided into twenty-five groups, according to their nature, and are quoted within each group in chronological order. The main group by far concerns sales *(escrituras de compraventa)*, 753 items dating from 1083 to 1303 (vols. 1 and 2, plus supplement in vol. 3). The third volume includes all the other documents dealing respectively with donations, emancipations of slaves, exchanges, quitrents, loans, pledges, leases, guardianships, plantations, deposits, cautions, litigations, agreements, renunciations of rights, fixations of boundaries, wedding contracts, testaments, division of goods, certificates of ownership, receipts, etc. They represent only the material aspects of life. Even the testaments, of which there are many (24), some of them very long, deal only with pieces of property, in great contrast with the ethical testaments of the Jews (ẓawwa'ah).

A valuable appendix to vol. 3 (p. 561 to 595) was contributed by JOSÉ M. MILLÁS VALLICROSA. Don José, who is professor of Hebrew in the university of Madrid, made a special study of some twenty documents written also in Arabic but in Hebrew script, dating from 1248 to 1282. They illustrate the triangular complexities of Toledan life and business.

The introductory volume is all that one would wish it to be. We find in it a complete description and history of the documents, a long discussion of Toledan topography, a study of the various populations involved with lists of the Mozarabic, French, and Jewish names, a

study on the language with glossaries, e.g., a long list of *aljamiadas* words (i.e., Latin and Romance words in Arabic dress), finally an elaborate analysis of Mozarabic institutions. It is a pity that these volumes contain no information on Mozarabic science,—whatever there was of it. Apparently these Mozarabs were interested only in religion, business, and ordinary life. Their numeration is a proof of their intellectual backwardness. The very full topographical and personal indices will be very precious to every student of mediaeval Spain. Thanks to the enlightened munificence of the Instituto de Valencia de Don Juan these volumes have been very handsomely published in a durable form.

The author, Don CÁNDIDO ANGEL GONZÁLEZ PALENCIA, has been connected for many years with the Toledan archives, he is professor of Spanish-Arabic literature in the University of Madrid. In spite of his relative youth (he was born in 1889) he has already published a great many books and memoirs. A full list of them would take too much space, but a few may be quoted : Edition and Spanish translation of a logical treatise, the *Taqwîm al-dhihn* of ABÛ-L-ṢALT of Denia (doctoral thesis, Madrid, 1915). Appendix to the *Takmila* of IBN AL-ABBÂR edited by FRANCESCO CODERA (Madrid, 1915). Collaboration to the *Manuscritos árabes y aljamiados de la Biblioteca de la Junta para Ampliación de Estudios* (Madrid, 1912). *Historia de la literatura arábigo-española* (Barcelona, 1928).

GEORGE SARTON.

Jean Deny. — *Sommaire des archives turques du Caire.* Société Royale de Géographie d'Egypte (Publications spéciales sous les auspices de S.M. FOUAD IER). Le Caire 1930. VIII+638 pp. (1 map, 56 plates).

JEAN DENY is well-known as one of the foremost and most prominent turcologists of the day. He is professor at the School of Oriental Languages, and author of by far the best Ottoman-Turkish grammar that has hitherto appeared (*Grammaire de la langue turque*, Paris 1921). From 1926 to 1930 he has been director of King FÛ'ÂD's private library in Cairo. And it is at the instigation of the Sovereign—who takes the greatest interest in all historical and scientific questions concerning Egypt—that he undertook a careful research into the half-forgotten Turkish Archives of Egypt. It is research of the greatest historical importance, as the political and administrative correspondence of MOHAMMED 'ALI PASHA (1805-48), Viceroy of Egypt and founder of the present dynasty, was entirely written in this language.

M. DENY has had to examine great funds of rolls, and some figures may best give an idea of the immense amount of work involved : The fund of the Royal Palace (*'Abdîn*) alone, comprises 363 registers with

65.590 items, amongst which is to be found the important correspondence of MOHAMMED 'ALI with his son and successor, IBRAHIM PASHA, and other generals, during his wars, from 1831 to 1848. The fund of the « Egyptian Archives » *(Defterkhâne)*, lodged in a picturesque old building in the Citadel of Cairo, is still more voluminous : it consists of 2244 registers with more than 141.000 rolls and letters, as well as an unknown number of military registers, and 38.000 documents of the « journal » *(rûznâme)*.

The main part of M. DENY's book begins with an important study of the different departments of the vice-regal services, the titles of the viceroy, the organisation of his cabinet and the different *divans*, etc. Then follow chapters on the contents of the documents, the administrative language, the calendar adopted by the Archives—a particularly complicated matter—, and a short record of the other Turkish-Egyptian funds existing in Egypt and abroad.

After this, the learned author gives the inventory of all the thousands of registers which he had to examine, a highly technical piece of work on account of the swirling Turkish *dîvânî* script in which they are written. For the readers of this Review the following chapters are of particular interest : Ministry of Public Instruction (p. 122 foll. and 435 foll.), Public Works, Commerce, Arsenal and Manufactories (pp. 465-66).

In the future it will be now possible for all scholars who are interested on the subject to consult these vast archives, hitherto inaccessible and now classified, for the first time, in M. DENY's useful book. Appendices, excellent indices, and photographic reproductions of important documents close the work. A map and some photographs show the buildings in which these old archives are deposited and give their location. For the book we have nothing but the highest praise. And it is splendidly printed by the renowned Press of the French Archeological Institute in Cairo.

MAX MEYERHOF.

J. Pérès. *Les sciences exactes.* — **Hélène Metzger.** *La chimie.* — **L. Ambard.** *La biologie.* 3e, 4e, et 5e parties de l'*Histoire du monde*, publiée sous la direction de E. CAVAIGNAC. 198 + 170 + 116 p., Paris, E. DE BOCCARD, 1930 (25+20+25 fr.)

Le T. XIIIe et dernier de l'*Histoire du monde*, publiée sous la direction de E. CAVAIGNAC est consacré à la civilisation européenne moderne ; il doit comprendre 7 fascicules consacrés aux arts plastiques, à la musique, aux sciences exactes, à la chimie, à la biologie, à l'électricité et à l'État. Passons sur cette distribution qui pourrait prêter à critique. J'ai entre les mains les trois parties ci-dessus signalées. Elles sont conçues sur des plans sensiblement différents : tandis que PÉRÈS suit le développement

des mathématiques depuis THALÈS jusqu'aux travaux les plus contemporains, Mme METZGER étudie l'histoire de la chimie du début du XVII^e s. jusque vers le milieu du XIX^e, et AMBARD envisage non pas la biologie, comme on est en droit de le croire, mais bien plutôt quelques problèmes médicaux contemporains.

Au reste, voici les titres des trois parties de l'étude d'AMBARD : les découvertes jusqu'au XIX^e siècle (22 p.) ; conception de la vie animale au XIX^e siècle (23 p.) ; quelques problèmes contemporains : l'anesthésie, l'œuvre de PASTEUR (considérée uniquement au point de vue médical), l'anaphylaxie, les néphrites, le diabète, la tuberculose. Pour ce qui n'est pas du domaine médical, la documentation d'AMBARD est parfois gravement en défaut : c'est ainsi que, p. 25 (à deux reprises, il ne s'agit donc pas d'une faute typographique), la découverte du principe de la conservation de l'énergie est attribuée à LOTHAR MAYER. Pas d'index, pas la moindre référence bibliographique.

J. PÉRÈS, professeur de mécanique à l'université de Marseille, a mieux réussi la tentative de faire tenir en 180 p. l'essentiel du développement historique des mathématiques, de la mécanique ; il ne parle qu'assez incidemment de l'astronomie, de la physique (ici, le principe de la conservation de l'énergie n'est même pas cité) et de la géodésie. La première moitié de l'ouvrage nous conduit jusqu'à DESCARTES et FERMAT ; la seconde jusqu'aux travaux de BOREL, VOLTERRA, etc. Mais le désir d'être le plus complet possible en si peu de pages crée un déséquilibre fatal : à mesure que les pages se suivent, le lecteur se trouve de plus en plus devant une accumulation de noms qui ne peuvent rien lui dire s'il n'est pas mathématicien (or le livre n'est pas destiné aux mathématiciens), ou de noms d'arguments mathématiques qui ne disent rien à son imagination. Pas d'index.

Nos lecteurs, qui connaissent Mme METZGER, tant par les études originales qu'elle a publiées ici, que par ses comptes rendus d'ouvrages ou ceux qui ont été donnés de ses livres, ne seront sans doute pas surpris si je leur déclare que son histoire de la chimie au laboratoire, écrite en 1926, est très supérieure aux deux volumes précédents : Mme METZGER était pleinement préparée à l'écrire. Elle a eu la chance d'avoir à sa disposition, toutes choses égales d'ailleurs, un espace plus grand que PÉRÈS et AMBARD, et elle a su l'employer en se limitant aux choses vraiment essentielles. Comme préambule, nous entrons dans un laboratoire du XVII^e siècle, nous prenons contact avec les instruments nécessaires à la profession du chimiste, avec ses réactifs ; nous vivons dès lors avec le chimiste dans son travail expérimental, ou dans les théories qu'il élabore, et nous ne le quitterons plus qu'après l'introduction de la physique dans les recherches chimiques. Ici, rien de discordant, rien de déséquilibré.

Bibliographie, index biographique très concis (d'où allègement du texte courant). L. G.

Arthur O. Lovejoy.—*The Revolt Against Dualism.* XII+325 p. The Open Court Publishing Co. (W. W. NORTON and Co.), Chicago, 1930. (Price $ 4.00.)

The book under review is a systematic survey and appraisement of the old epistemological problem : Are nature and man's apprehension of nature essentially separate things or can they be fused together into a monism free from logical contradictions ? The author views the present philosophical situation as a revolt against the dualism of DESCARTES and GALILEO which postulated a distinction between *objective* nature and a *subjective* awareness of the activities of nature. He traces the history of the conflict from the beginning of the modern revolt in the work of WILLIAM JAMES and G. E. MOORE to its culmination in A. N. WHITEHEAD's denial of a « bifurcation of nature » through exposition of the « fallacy of simple location » and in BERTRAND RUSSELL's attempt to establish a « unification of mind and matter ».

One especially noteworthy feature of the book is the admission made at the beginning of the eighth chapter that the confusion among philosophers is to be traced in large part to the lack of carefully phrased definitions and to the failure to realize that a system of philosophy arises from the exploration of the logical implications of a system of postulates. His opinion is that « the haste of many philosophers to settle what appear to be the more fundamental issues first, and their consequent reluctance to discuss in a spirit of scientific detachment questions of the mere congruity of suppositions, has been highly detrimental to philosophy. It tends, for one thing, to bring the more controversial and less soluble problems to the fore from the start, and thus renders effective cooperation between philosophers having different convictions on fundamental and (supposedly) non-hypothetical questions difficult and unusual. »

This point, perhaps too easily admitted on all sides, is frequently neglected in application and one leaves a debate of the nature presented in the volume under review with the feeling that a frank admission of a confusion of definition and postulate is highly to be desired. Two courses are open to the philosopher. He may take the position advocated by P. W. BRIDGMAN that « the concept is synonymous with the corresponding set of operations » and assert that it is meaningless to ask such questions as : « Why does time flow ? », « May space be bounded ? », « Why does nature obey laws ? » and presumably also, «Is nature and man's perception of it a dual system ? » The second course is to approach a philosophical system which is not subject to exploration by direct operations, through

a set of postulates. All that remains is the discussion of their logical consistency. A beautiful example of this point of view is furnished by the naive way in which W. DE SITTER, the Dutch astrophysicist, derived his celebrated « wall-of-time » theory of space-time. What a declaration of independence is found for philosophy in the following dictum : « How the (gravitational potentials) are in those portions of space and time to which our observations have not yet penetrated, we do not know, and how they are at infinity (of space or of time) we shall never know. All assumptions regarding the value of the (gravitational potentials) at infinity are therefore extrapolations which we are free to choose in accordance with theoretical or philosophical requirements. »

Professor LOVEJOY, following his own advice, is very careful in the first chapter to enumerate the assumptions that underlie the two fundamental terms : *epistemological dualism* and *psychophysical dualism*. To the first he ascribes the five assumptions : (1) that some cognoscenda are external to the body of the percipient ; (2) man has a real traffic with by-gone or future things ; (3) man wants to know things in their reality—entities as they would be if unknown ; (4) social realism implies that he can know what is other than his own experience, i.e. the experience of others ; (5) there exists a world known to others even when he is not there.

Psychophysical dualism is characterized by five properties inherent in man's concept of natural realism :

(1) It is spacial as well as temporal ; (2) some or all its parts continue to exist during inter-perceptual intervals ; (3) causal relations exist ; (4) these causal relations are independent of perception ; (5) order is a common factor in experience.

The book, exploring the admissions implied by these ten assumptions, falls naturally into five parts. The first of these records the failure of what the author calls objectivism, the second relates the essential fallacies of objective relativism, the third controverts WHITEHEAD's denial of simple location, the fourth elaborately reviews and finally rejects RUSSELL's attempt to unify mind and matter, the fifth appraises the discoveries of modern physics and relates them, particularly the theory of relativity and the dilemma of wave mechanics, to the problem of dualism.

The final conclusion of the author seems to be that the revolt against dualism has been a failure, but he does not advance a positive theory of his own to indicate the exact nature of the dualism that presumably remains.

The argument throughout the book is logically expressed but very closely knit. The style is clear but the book can not be read with haste. The summaries are not sharply delineated and there is a lack of sub-titles

which would make a preliminary orientation much easier and the consequent digestion of the book more rapid.

One feels throughout a discussion of this kind the great desirability of a *concise* definition of terms. Perhaps, however, this ideal is an impossible one for philosophy and the nature of the concepts involved precludes that exact formulation of definition and postulate with which physicists and mathematicians have made such notable progress in their sciences. The difference between epistemological dualism and psychophysical dualism for example is indicated, as we have shown above, in terms of certain characteristics of man's perception, but an unambiguous definition of either term without the intrusion of other equivalent terms does not seem possible of attainment.

The author very happily notices the equivalence of the ZENO paradox and the HEISENBERG principle of indeterminacy which, without its philosophical background, has been sadly puzzling to the physicist. In this connection it seems regrettable to the reviewer that nothing is said in the book about the logical foundation of number since this is a fruitful concept for probing epistemological problems. The intuitionalism of BROUWER with his denial of the universality of the law of the excluded middle, the transfinite axiom of HILBERT, and the reflections of POINCARÉ on the relationship between nature and the measurement of nature are important aspects of the knowledge problem since they are logical outgrowths of the paradoxes of ZENO and are the subjective idealization of the puzzles presented by the wave electron and the HEISENBERG principle.

The survey of the modern discoveries and conclusions of physics has been well done. The author, however, after reviewing the reasons which have led physicists much against their will to assume that radiation in one activity exhibits an undulatory character and in another just as conclusively a corpuscular nature, concludes : « A theory which seems to imply that the imperceptible entities or events inferred to account for perceptible events are self-contradictory is obviously unsatisfactory ; it stands in need of some sort of supplementation or modification to remove the contradiction. »

The author here, perhaps, misses his finest philosophical opportunity. Let us assume that the physical facts are as the laboratory finds them. There is now too much evidence from many points of view to give great hope that the experimental situation will be materially changed. Radiation has a dual and contradictory nature. Is this more surprising than the situation in 1905 when EINSTEIN accepted the experiments which stated that matter moved with respect to the ether and yet did not? The first theory of relativity in one sense is a device for getting our minds accustomed to these experimental facts. Perhaps the greatest

service that can be done by the philosopher in his exploration of the basis of dualism is to find some device by means of which man's intelligence can become reconciled to these contradictions in nature. In this connection BERTRAND RUSSELL in the concluding sentences of his « A, B, C of Atoms » makes the significant remark : « This makes it plausible to suppose that every apparent law of nature which strikes us as reasonable is not really a law of nature, but a concealed convention, plastered on to nature by our love of what we in our arrogance, choose to consider rational... This raises a somewhat important question : Is the world ' rational ', i.e. such as to conform to our intellectual habits ? Or is it ' irrational ', i.e. not such as we should have made it if we had been in the position of the Creator ? »

The reviewer would like to conclude with a word of appreciation for the Open Court Company which has made this stimulating volume possible. The book is the second published under the foundation established in memory of PAUL CARUS, former editor of the *Open Court* and the *Monist*.

(Indiana University) H. T. DAVIS.

Ernst Zinner. — *Verzeichnis der astronomischen Handschriften des deutschen Kulturgebietes.* 544 p. München, BECK, 1925 (RM. 30).

This folio volume was lithographed from a MS., presumably in the author's own hand. It is a catalogue of astronomical MSS. found in the libraries of Germany, Austria, Switzerland, Belgium, the Netherlands, Luxemburg ; also in the libraries of Prague and Cracow, and it includes references to a number of MSS. which are now in the keeping of other countries. To define the author's field of investigation, it will be best to use his own words :

« In dem Verzeichnis wurden berücksichtigt die in Latein oder in seinen Tochtersprachen oder in den germanischen Sprachen geschriebenen Werke und zwar bis zum Jahre 1850. Dabei wurden Sternforscher, deren Hauptschaffen nach 1850 lag, weggelassen. Abschriften von Drucken wurden nicht aufgenommen. Was den Inhalt anlangt, so kamen alle Handschriften zur Sternkunde und Sternforschung in Betracht, ferner die Handschriften zur Sterndeutung und zur Erdmessung. Alle Schriften über Zeitrechnung wurden berücksichtigt, ferner alle Kalender bis zum 12. Jahrhundert ; die späteren nur dann, wenn sie mindestens Neu- und Vollmonde enthielten und ab 1550 nur die zu Jahrbüchern gewordenen Kalender. Alle Schriften über Uhren wurden bis 1500 aufgenommen ; die späteren nur wenn sie sogenannte Planetenuhren betreffen, dagegen sämtliche Schriften über Sonnenuhren. »

It is of course impossible to appreciate at once exactly the value of

such a work. Only by long usage could its completeness and accuracy be estimated. The catalogue proper, covering 369 p. and listing 12563 or 12617 items (see a few addenda on p. 542-44), is followed by 156 p. of notes some of which are very valuable. By way of test, I have examined the items and notes relative to the main astronomers of the second half of the thirteenth century, and have thus obtained two interesting results.

The author says that WILLIAM OF SAINT CLOUD was an Englishman and he boldly calls him « WILHELM VON ENGLAND ». He says that he flourished c. 1292-94 and wrote a calendar for Queen ELIZABETH (p. 413). Now I do not know any queen of that name and time, unless it be the Angevine princess who became the wife of LADISLAUS IV THE CUMANIAN, king of Hungary, and died in or after 1300. Of course this is not impossible, but is it not rather a confusion with Queen MARY OF FRANCE, the second wife and widow of PHILIP THE BOLD, who was queen from 1274 to 1321?

In some MSS., PETER OF DACIA or PETRUS PHILOMENI was apparently called PETRUS DANUS DE S. AUDOMARO (i.e., Saint Omer, Pas-de-Calais). Is this a confusion of names or a confusion of personalities? Was this Danish Peter actually connected with Saint Omer? These two questions would deserve investigation, and I am convinced that further use of ZINNER's splendid catalogue would lead to many other problems of the same kind, but that is just as it should be.

With regard to the general arrangement of it my only regret is that the author did not complete it with various indices and statistical summaries which would have increased its practical and theoretical value immeasurably. The only statistical data which I found are the following. Out of the 12617 MSS. listed, at least 36 % are duplicates. Those written before 1500 and already investigated form 18.5 % of the total; these 18.5 % are subdivided as follows: 0.6 % refer to the ancient knowledge, 1.2 % to the Arabic, 0.6 % to the Jewish, 1.3 % to original efforts of the early Middle Ages, 11.9 % to efforts of the later Middle Ages. (It should be noted that this is almost meaningless without further definition and explanation). An index of proper names would have been very useful, e.g., the names of addressees of letters. The authors represented in the catalogue are arranged in alphabetic order, and this is naturally a source of many difficulties, for the names of mediaeval authors are very hard to standardize. For example, JOHN OF HALIFAX is classified under HOLYWOOD, which is proper; but he might have been put in many other places: SACROBOSCO, JOHANNES, etc. To be sure there are many cross references, but these are not always sufficient. As is always the case for lists compiled by non-Orientalists, the Arabic

names are badly treated. A number of them are classified under the article el ! (which by the way is often spelled al or ul). Again this would have been neatly remedied if the author had added indices of Arabic and Persian authors, as well as of Greek ones, etc. Then the classification, however irregular, would not have mattered any more, and the reader could have seen at a glance how many Arabic authors were represented and who they were.

Some observations with regard to subjects. Anonymous MSS. are classified according to subjects : Gestirnung, Armilla, Astrolab, Sterndeutung, Jahrbuch, Kalender, Sterndeutung, Tafeln, etc. A separate list of these Stichwörter would have been very helpful. It is not yet too late to publish these supplementary indices, and I much hope that the author may be persuaded to do so and thus to increase our heavy debt to him. GEORGE SARTON.

Emanuel Rádl.—*The history of biological theories.* Translated and adapted from the German by E. J. HATFIELD. XII+408 p., Oxford University Press, American Branch, 114 Fifth Avenue, New York City, 1930.

This is a condensed adaptation by the author not of his History of biological theories, but only of a part of the second volume of it. As the author and translator are a little vague on the subject, let us be clear. RÁDL published the first volume of his *Geschichte der biologischen Theorien* in 1905 ; that first volume told the story down to the beginning of the nineteenth century ; the second volume dealing with the rest of that century appeared in 1909. A completely revised edition of vol. 1 was published in 1913. Now the present book is a condensation of vol. 2, of 1909, p. 107-580.

As I devoted a very long review to RÁDL's history in *Isis* (vol. 2, 224-29), and referred to it again in my review of ERIK NORDENSKIÖLD's history (*Isis*, 12, 336), it is not necessary to start a new discussion of it. The author, who is professor in the Karlova Universita of Prague,—not of « natural philosophy » as the title page says, but of « Naturphilosophie » which is a totally different matter—might be described as a disillusioned biologist. As far as I could judge, his philosophical ideas have not varied much since 1909, but his disillusion and his need of new and fantastic illusions have steadily increased. Instead of its misleading title, the English translation might have been called « From Darwin to Driesch ». It is very surprizing that it was prepared at JULIAN HUXLEY's instigation; one cannot help wondering how much HUXLEY knew of RÁDL's work when he advised Miss HATFIELD to translate it. At any rate there is no doubt that this book will prove very stimulating, sometimes to the

point of exasperation, but it should not be put into the hands of immature and defenceless students.

Contents : 1. The advent of Darwinism ; 2. CHARLES DARWIN ; 3. ALFRED RUSSEL (incorrectly printed throughout RUSSELL)WALLACE ; 4. The reception of the Darwinian theory ; 5. Criticism of Darwinism by those still in favour of the older schools of thought ; 6. Evolutionary philosophy and ethics ; 7. The influence of the Darwinian theory in other fields of intellectual activity ; 8. Darwinism and religion ; 9. Beauty in the world of living organisms ; 10. Mimicry ; 11. Progress and decay ; 12. ERNST HEINRICH HAECKEL ; 13. Spontaneous generation ; 14. Anthropology ; 15. Human races ; 16. Darwinian morphology and embryology ; 17. The geographic distribution of animals and plants ; 18. Palaeontology ; 19. Natural selection ; 20. CARL VON NÄGELI ; 21. The cell theory after the time of DARWIN ; 22. Human heredity ; 23. The later history of the theory of natural selection ; 24. Psychology ; 25. The Lamarckians ; 26. Genetic ideas in botany ; 27. The doctrine of individuality ; 28. Species and sub-species and their use in classification ; 29. Reproduction ; 30. Hybridization ; 31. The mechanistic view of development ; 32. DRIESCH ; 33. Darwinism in decline ; 34. The nature of scientific history ; Index.

G. S.

Twenty-ninth Critical Bibliography

of the

History and Philosophy of Science and of the History of Civilization.

(*to May* 1930)

This Twenty-ninth Bibliography contains about 723 items, some of which have been kindly contributed by the following scholars :

C. W. Adams (Hertford, Eng.).
M. Bloch (Leningrad).
F. M. Feldhaus (Berlin).
L. Guinet (Brussels).
E. Honigmann (Breslau).
E. Kremers (Madison, Wis.).
A. Marx (New York).
A. Pogo (Cambridge, Mass.).
L. Thorndike (New York).
H. Wieleitner (Munich).
J. K. Wright (New York).

This bibliography includes the eleventh series of addenda and errata to Volume I of my *Introduction to the History of Science* (Baltimore and London, 1927). An author's index will be found at the end.

Papers and books sent to the Editor are entered into this bibliography if they are relevant to its purpose. They may be the object of analytical notes or longer reviews, if this seems sufficiently necessary and the services of competent scholars are available. It is obvious that only a small number of publications can be adequately reviewed and that it is not even possible to give a brief description of each and every one. However, our classification is so comprehensive and so minute, that even if we do nothing but give the accurate title of an item and put it in the proper place, we are already rendering a real service to the author, the publisher and the learned public. There is no relation between the importance of a publication and the length of the note devoted to it.

The ultimate aims of this undertaking are : (1) to establish the History of Science as an independent discipline ; (2) to demonstrate inductively the Unity of Knowledge and the Unity of Mankind ; (3) to serve as a center of information and rallying ground to the scholars engaged in our studies.

Harvard Library, Room 185.
Cambridge, Massachusetts.

George Sarton.
June 6, 1930.

PART I

FUNDAMENTAL CLASSIFICATION (CENTURIAL)

IXth Century B. C.

Fuld, Ernst. Wissenschaft bei HOMER und Kritik. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 152-83, 1930. ISIS

VIth Century B. C.

Pien Ch'iao (*Introduction*, I, 102). This Chinese physician ought to have been placed in the VIth century B. C. rather than in the Vth. I was misled by GILES' Biographical dictionary. According to SSU-MA CH'IEN, he must have flourished c. 531-26. The German translation of which I said on p. 103 that it was made by FR. HÜBOTTER but as yet unpublished is included in the latter's mimeographed book *Die chinesische Medizin* (1929, 195-238, see also p. 12; *Isis*, 14, 255-65). G. S. ISIS

Vth Century B. C.

Chance, Burton. On HIPPOCRATES and the aphorisms. *Annals of Medical History*, 11, 31-46, 12 fig., 1930. ISIS

Hennig, Richard. Der Araxes des HERODOT = die Wolga. *Petermanns Mitteilungen*, 75. Jahrg., p. 169-74, 1929. ISIS

Jacobj, Gerhard. Geographische Beobachtungen und Anschauungen im Corpus Hippocrateum. *Inaug. Diss.* Jena. 64 p. Jena, 1928. ISIS

Systematic exposition of the geographical data in the Corpus Hippocrateum, a body of observations overlooked by such modern writers on the history of ancient geography as PESCHEL, GUNTHER, and KRETSCHMER.

J. K. W.

Koch, Richard. Auslegung des ersten hippokratischen Aphorismus. GEORG STICKER Festgabe, 1-10, Berlin, SPRINGER, 1930. ISIS

Oliver, John R. The philological approach to the Hippocratean corpus. WELCH Festschrift. *Bull. of the Johns Hopkins Hospital*, 46, 142-44, 1930. ISIS

Sigerist, Henry E. Fragment einer unbekannten lateinischen Über-

setzung des hippokratischen Prognostikon. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 87-90, 1930. ISIS

The Prognosticon was translated into Latin by CONSTANTINE THE AFRICAN, but there are also two much earlier translations, of which one was edited by KÜHLEWEIN in 1890 (*Hermes*, 25, 113-40). The second one derived from a St. Gall MS. of the ninth or tenth century is here edited. G. S.

Sudhoff, Karl. Sketches. I. An account of the most ancient trade relations of Cnidos and Cos ; II. The Doric settlement of the island of Cos. III. Where was HIPPOCRATES the Great born? *Annals of Medical History*, 11, 13-19, 10 fig., 1930. ISIS

Sticker, Georg. Fieber und Entzündung bei den Hippokratikern. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 40-67, 1930. ISIS

IVth Century B. C. (whole and first half)

Bérard, Victor. L'Atlantide de PLATON. *Annales de Géographie*, 38, 193-205, 1929. ISIS

« C'est au pays de Gadiros-Eumèlos, sur la côte d'Espagne, qu'il faut chercher cette Atlantide et qu'on peut la retrouver, car elle n'a disparu que dans le mythe platonicien. » J. K. W.

IVth Century B. C. (second half)

Hüsing, Georg. Panchaia. *Beiträge zur historischen Geographie, Kulturgeographie, Ethnographie und Kartographie*, vornehmlich des Orients, hrsg. von HANS MZIK. p. 99-111, 2 maps. Leipzig, DEUTICKE, 1929. ISIS

Identifies Panchaia, the island described by EUHEMEROS OF MESSINA (fl. c. 316 B.C.), with Kishm at the entrance of the Persian Gulf. J. K. W.

Ross, W. D. ARISTOTE. Préface de D. PARODI. 420 p., Paris, PAYOT, 1930 (30 fr.) ISIS

A maintes reprises, SARTON a dit ici tout le bien qu'il pensait de la traduction anglaise des œuvres d'ARISTOTE dirigée par W. D. ROSS, professeur de philosophie à l'université d'Oxford (voir notamment vol. 6, p. 138; 7, p. 532; 8, p. 773; 11, 155, 407). Cette traduction et une édition avec commentaires de la Métaphysique justifient amplement l'exposé complet que donne ROSS de l'œuvre d'ARISTOTE (édit. anglaise, 1923; *Isis*, 7, 177), exposé dont paraît, sans nom de traducteur, une édition française, dont PARODI peut dire justement dans sa préface : « Mais l'ouvrage se recommande par d'autres qualités encore, qui sont celles même de l'esprit de l'auteur : une probité scientifique rigoureuse; un souci d'exactitude qu'on ne prend jamais en défaut; une absence totale de tout esprit de système qui inspire pleine confiance, et surtout peut-être un don remarquable de clarté. On ne trouvera pas ici de

savantes discussions sur les points obscurs de la doctrine, ni d'ambitieuses tentatives pour l'interpréter, ni une laborieuse critique de ce qui en est définitivement mort ou de ce qui en survit... Au reste, M. Ross insiste moins sur les parties les plus connues de l'aristotélisme et sur sa métaphysique que sur les traités que l'on néglige volontiers, les traités biologiques par exemple, ou les traités moraux; et il lui arrive d'y découvrir encore, au milieu des décombres de la science antique, des pressentiments singuliers de plus d'une conception moderne ». L. G.

IIIrd Century B. C. (whole and first half)

(Manethon). It is not enough to say that MANETHON was an astrologer (*Isis*, 13, 404); an astrological work ascribed to him is extant. For editions of it see my *History of magic and experimental science* (vol. 1, 291-93). L. T. ISIS

IIIrd Century B. C. (second half)

Bortolotti, Ettore. A chi dobbiamo il recupero dell'opera di APOLLONIO su le coniche? *Archeion*, 2, 395-6, 1929. ISIS

On va répétant que c'est à l'aide d'un MS. arabe vendu par GOLIUS au grand duc de Toscane que nous connaissons les livres V, VI, VII, des coniques d'APOLLONIUS. Or FERDINAND I^er^ est mort en 1609 et GOLIUS est né en 1596. En réalité le MS. de Florence avait été donné à FERDINAND I^er^ par le patriarche d'Antioche IGNACE NEAMA. Quant aux autres livres des coniques, ils ont été introduits en Italie par FRANCESCO FILELFO en 1427; des fragments en furent publiés en latin en 1510 par GIORGIO VALLA; une version complète en fut donnée en 1537 par G. B. MEMMO, précédant la célèbre version de FEDERICO COMMANDINO (1566). (Voir *Isis*, 7, 178). L. G.

IInd Century B. C. (whole and first half)

Eudoxos, Papyrus of (*Introduction*, I, 184). HEATH in ARISTARCHUS OF SAMOS, (Oxford, 1913) p. 112, says: 'the Didascalia caelestis of Leptines, known as Ars EUDOXI' and p. 200, footnote: 'TANNERY prefers the title restored by LETRONNE, Didascalie céleste de Leptine' C. W. ADAMS. ISIS

Ist Century B. C. (second half)

Lulofs, H. J. STRABO over Scythen: Specimen van antieke anthropogeographie. (*Geographische en geologische mededeelingen*. Publicaties uit het geografisch en uit het mineralogisch-geologisch instituut der Rijksuniversiteit te Utrecht. Anthropogeographische reeks No. 1.) 39 p., map. Utrecht, OOSTHOEK, 1929. ISIS

Ist Century (second half)

Heine-Geldern, Robert. Orissa und die Mundavölker im 'Periplus des Erythräischen Meeres'. *Beiträge zur historischen Geographie, Kulturgeographie, Ethnographie und Kartographie*, vornehmlich des Orients, hrsg. von HANS MZIK. p. 157-71, 1 map. Leipzig, DEUTICKE, 1929. ISIS

IInd Century (whole and first half)

Kraus, Karl. Über die Grundlagen der Terminologie in der «Geographie» des PTOLEMAEUS. *Beiträge zur historischen Geographie, Kulturgeographie, Ethnographie und Kartographie*, vornehmlich des Orients, hrsg. von HANS MZIK. p. 144-56. Leipzig, DEUTICKE, 1929. ISIS

Ueta, Joe. A paradox in astronomy. *Popular astronomy*, 38, 249, 1930. ISIS

Note concerning the absence, in the Almagest, of references to the brightest star in Eridanus, Achernar, declination—57°45' (equinox 1900). J. UETA, of the Kyoto University Observatory, computes the declination,—66°52', for the equinox A.D. 200, and thus proves that the star was then invisible even far south of Alexandria (latitude 31°11'). Hence, Achernar has no bearing on the relation of the Almagest to older catalogues (HIPPARCHOS) based on observations made in higher latitudes. A. P.

IInd Century (second half)

Dionysius Byzantius. DIONYSII BYZANTII Anaplus Bospori una cum scholiis X saeculi edidit et illustravit RUDOLF GÜNGERICH. LXXV+45 p. *(Inaug.-Diss.)* Berlin, WEIDMANNsche Buchhandlung, 1927. ISIS

Reviewed by K. v. FRITZ, *Deutsche Literaturzeitung*, 2003-05, 1929, and by PAUL GRAINDOR, *Byzantion*, 3, 503, 1928.

Meyerhof, Max. La version arabe d'un traité perdu de GALIEN. *Byzantion*, 3, 413-42, 1928. ISIS

Apropos of the *περὶ τῶν ἰατρικῶν ὀνομάτων*, a dictionary of medical terms which exists neither in Greek, nor in Latin, nor in Syriac, but of which a part is available in Arabic (Leiden, Ms. Or. 585). G. S.

IIIrd Century (whole and first half)

Hua T'o (*Introduction*, 1, 325). It was not enough to say he was a surgeon; he was practically the only Chinese surgeon, that is, if acupuncture is not considered surgery. He set forth interesting

views on gymnastics. FR. HÜBOTTER: *Die chinesische Medizin* (1929, 315-16; see *Isis*, 14, 255-63). G. S. ISIS

Rehm, Albert; Schramm, E. BITONS Bau von Belagerungsmaschinen und Geschützen. Griechisch und deutsch. 28 p., 6 pl., 10 fig. (*Abh. d. Bayer. Akad. d. Wiss., Philos.-hist. Abt.*, neue Folge 2, 1929). München, OLDENBOURG, 1929. ISIS

Reviewed by ROBERT GROSSE, *Deutsche Literaturzeitung*, 1, 843-44, 1930.

IIIrd Century (second half)

Wang Shu-ho (*Introduction*, 1, 342). The German translation by HÜBOTTER, which I announced, is the translation not of the *Mo-ching* but of the *Mai-chüeh* (7615, 3225), which was ascribed to WANG SHU-HO, but was composed by KAO YANG (5927, 12883), presumably after the eleventh century (?), together with a commentary by CHANG SHIH-HSIEN (416, 9969, 4513), as edited by HSÜ ANG (4748, 75). This translation has finally appeared in FR. HÜBOTTER: *Die chinesische Medizin* (1929, 239-72; see *Isis*, 14, 255-63). The *Mo-ching* was divided into 10 books; the *Mai-chüeh* according to HÜBOTTER's translation contains only four books. The relation of those two works, both dealing with the pulse, is not yet clear to me. I have no time now to investigate the matter. A French translation of the *Mo-ching* by Father HERVIEU is included in J. B. DU HALDE: *Description géographique de l'Empire de la Chine* (1735). G. SARTON. ISIS

Vth Century (second half)

Ganguli, Saradakanta. The elder ARYABHATA's value of π. *American Mathematical Monthly*, 37, 16-29, 1930. ISIS

« In the absence of fresh evidence to the contrary, the credit of discovering the value 62832/20000 (= 3.1416) of π must, in all fairness, go to the elder ARYABHATA. We do not know how ARYABHATA obtained this value of π. He might have got it by actual measurement of the circumference of a circle of radius 10000 or by calculation of the length of the perimeter of a regular polygon of a very large number of sides inscribed in such a circle. »

Kimura, Taiken. The date of VASUBANDHU seen from the *Abhidharma-Kośa*. The four texts. Indian Studies in honor of CHARLES ROCKWELL LANMAN, 89-92, Cambridge, 1929. ISIS

« Judging from the dates of translation of the Chinese *Abhidharma* texts, we can say that the *Abhidharma-kośa* was not yet in existence in A.D. 430, and consequently during this period the new VASUBANDHU had not yet entered upon his career as the author of either the Realistic school or the Idealistic

school. Those who assign him a date in the third or fourth century are, I think, confusing the old with the new. I, for my part, consider the date A.D. 420-500 to fit our great philosopher best.»

Klibansky, Raymond. Ein Proklos-Fund und seine Bedeutung. 41 p. *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, philosophisch-historische Klasse*, Jahrgang 1928-29. 5. Abhandlung, 1929. ISIS

Latin translation of the end of PROCLOS's commentary on the *Parmenides*. It was probably made by WILLIAM OF MOERBEKE. The author shows the importance of that translation (1) for the PROCLOS text, (2) for the text of the *Parmenides*, (3) for the study of mediaeval Platonism, (4) for the comparison of the commentaries on the *Parmenides* by PROCLOS and NICHOLAS OF CUSA. Four extracts from the translation are quoted. G. S.

Ono, Genmyo. The date of VASUBANDHU seen from the history of Buddhist philosophy. Indian Studies in honor of CHARLES ROCKWELL LANMAN, 93-94, Cambridge. 1929. ISIS

«To sum up, the theory of the eight vijñānas is established out of the idea of the Buddha-gotra and the Tathāgata-garbha and with the development of the eight vijñānas the theories of the tri-kāya and the caturjñānas are completed. If we examine the whole of the translated texts, we find no trace at all during the fourth century. At the beginning of the fifth century, we notice some germs of them appearing; but from the middle of the fifth century down to the beginning of the sixth century, we feel the ideas fully developed and ripened. Since the systematization of the theories belongs to ASANGA, and especially to VASUBANDHU, their activity may be considered to cover the middle of the fifth century and after.»

Takakusu, Jyan. The date of VASUBANDHU, the great Buddhist philosopher. Indian Studies in honor of CHARLES ROCKWELL LANMAN, 79-88, Cambridge, 1929. ISIS

Supporting the date c. 420-500, already defended by him in 1905. In my *Introduction* (vol. 1, 350) I placed VASUBANDHU in the first half of the fourth century, following N. PERI (1911). G. S.

VIth Century (whole and first half)

Collinet, Paul. Les preuves directes de l'influence de l'enseignement de Beyrouth sur la codification de JUSTINIEN. *Byzantion*, 3, 1-15, 1927. ISIS

Lehmann, Hermann. Zu AËTIUS AMIDENUS. *Sudhoffs Archiv für Geschichte der Medizin*, 205-06, 1930. ISIS

VIIIth Century (whole and first half)

Tu Fu. TU FU, the autobiography of a Chinese poet, A.D. 712-770, including an historical year record, a biographical index, and a topographical note, as well as maps, plans, and illustrations. Arranged from his poems and translated by FLORENCE AYSCOUGH. Vol. 1: A.D. 712-759. 450 p., ills. London, JONATHAN CAPE, 1929. ISIS

Reviewed by A. C. MOULE, *Journal of the Royal Asiatic Society*, 212-14, 1930, and by O. FRANKE, *Deutsche Literaturzeitung*, 1, 102-06, 1930.

IXth Century (whole and first half)

Janos, Eckmann. Keleteurópa és Nyugatázsia a legrégibb arab térképen. (Adalék az arab kartografia történetéhez.) *Földrajzi Közlemények*, LVII Kötet, p. 91-105, with a German summary, p. 129-30, 1929. ISIS

Reconstruction of the AL-KHUWĀRIZMĪ's map of western Asia and eastern Europe. Though based on it, AL-KHUWĀRIZMĪ's map is markedly inferior to that of PTOLEMY. J. K. W.

Mzik, Hans. Parageographische Elemente in den Berichten der arabischen Geographen über Südostasien. *Beiträge zur historischen Geographie, Kulturgeographie, Ethnographie und Kartographie*, vornehmlich des Orients, hrsg. von HANS MZIK, p. 172-202, map. Leipzig, DEUTICKE, 1929. ISIS

A study of false and misleading geographical concepts in the Kitâb ṣûrat al-arḍ of AL-KHWĀRIZMĪ. J. K. W.

Secretum secretorum (*Introduction*, vol. 1, 556-57). On the French versions see CH. V. LANGLOIS: *La connaissance de la nature et du monde*. 2e édition (*La vie en France au moyen âge*, vol. 3, 71-121, 1927). ISIS

IXth Century (second half)

Honigmann, Ernst. Bemerkungen zu den geographischen Tabellen AL-BATTĀNĪ's. *Rivista degli studi orientali*, 11, 169-75, 1927. ISIS

« Die geographischen Tabellen AL-BATTĀNĪ's wurden nach der ersten Bearbeitung durch LELEWEL neuerdings von NALLINO zuerst in einer besonderen Abhandlung und später in seiner grossen Ausgabe AL-BATTĀNĪ's neu herausgegeben und mit wertvollen Erklärungen versehen. Für die weitaus grösste Zahl der Länder- und Ortsnamen kann man seinen Kommentar für hinreichend und vollkommen abschliessend erklären; doch musste auch bei ihm Vereinzeltes infolge der schlechten Überlieferung der Tabellen noch unklar und zweifelhaft bleiben. Im Folgenden soll versucht werden, durch

einige Nachträge die Zahl der ungeklärten Punkte etwas zu verringern; für den Rest müssen wir uns freilich noch weiterhin mit einem *ignoramus* begnügen. »

Ḥunain ibn Isḥâq. The book of the ten treatises on the eye ascribed to ḤUNAIN IBN ISḤÂQ (809-877 A.D.). The earliest existing systematic text-book of ophthalmology. The Arabic text edited from the only two known manuscripts, with an English translation and glossary by MAX MEYERHOF. LIII+227 p. Arabic text, 230 p. Cairo, Government Press, 1928. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 106-09, 1929.

Malone, Kemp. King ALFRED's north: a study in mediaeval geography. *Speculum*, 5, 139-67, 5 pl., 1930. ISIS

« Our examination of the geographical chapter of ALFRED's OROSIUS has brought out the fact that ALFRED uses two distinct systems of orientation, which may be named the classical and the shifted. The shifted system is most prominent in his interpolations, but is by no means confined to these. »

Marçais, W. Quelques observations sur le texte du « Kitâb el-Bukhalâ » (Le livre des Avares) d'EL-JÂḤIẒ. Mélanges RENÉ BASSET, vol. 2, 431-41, Paris, 1925. ISIS

Schacht, Joseph. Das kitâb adhkâr al-ḥuqûq war-ruhûn aus dem al-jâmi' al-kabîr fish-shurûṭ des ABÛ JA'FAR AḤMAD IBN MUḤAMMAD AṬ-ṬAHÂWÎ. VIII+42 p. *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, philosophisch-historische Klasse*, Jahrgang 1926-27. 4. Abhandlung, 1927. ISIS

The author, ABÛ JA'FAR AḤMAD IBN MUḤAMMAD IBN SALÂMA AL-AZDÎ AL-ṬAHÂWÎ, was born c. 844 or 853 and died c. 933. He wrote among other works three treatises on shurûṭ (legal conditions). The present text is the remaining part of one of these treatises, the Kitab al-shurûṭ al-kabîr. Says the author : « In der vorliegenden Arbeit wird ein Text zugänglich gemacht, der als ältester erhaltener Vertreter der shurûṭ-Literatur für die Erforschung der islamisch-rechtlichen Urkundenformen von grundlegender Bedeutung ist. Besondere Wichtigkeit kommt ihm deshalb zu, weil er die ihm vorausgehenden, uns sämtlich verlorenen gleichartigen Schriften unter Quellenangabe eingehend benutzt. Aber nicht nur innerhalb dieses einzelnen Literaturzweiges des Fiqh nimmt er eine hervorragende Stellung ein, auch das Bild der Sharî'a als Ganzes wird unvollständig, wenn man die in den shurûṭ-Büchern schon in alter Zeit hervortretende höchst eigenartige Denkweise, die mit der die ḥiyal-Literatur charakterisierenden in etwa verwandt ist, ausser acht lässt. In den landläufigen Fiqh-werken tritt sie trotz ihrer hervorragenden Wichtigkeit für die Rechtspraxis kaum in Erscheinung. »

(Thâbit ibn Qurra). The book of al-dakhīra. Edited by G. SOBHY.

xviii+44 p. in English ; 186 + 6 pages in Arabic ; 3 pl. Cairo, Government Press, 1928 (30 piastra). ISIS

Reviewed by George Sarton, *Isis*, 364-5, 1930.

Xth Century (second half)

Arberry, Arthur J. The Mawâqif of al-Niffarî (d. 965). *Journal of the Royal Asiatic Society*, 404-06, 1930. ISIS

« The Mawâqif is a treatise on speculative mysticism, written by Muḥammad ibn 'Abdul l-Jabbār ibn al-Ḥasan al-Niffarī in the tenth century A. D. Its contents have been described and illustrated by Professor Nicholson and Professor Margoliouth ; Dr. Massignon refers to the work, but expresses doubts as to its authenticity as a fourth century (Hijra) document. »

Ḥasdai ibn Shaprut (*Introduction*, vol. 1, 680 ; *Isis*, 13, 417). The identification of the Jew Hasdeu with Ḥasdai was first made by Philoxène Luzzatto, *Notice sur* Abou-Jousouf Hasdai ibn-Schaprout, Paris 1852, p. 16 and was accepted by Dozy, *Histoire des Musulmans d'Espagne*, 3, p. 83 ff. A. M. ISIS

XIth Century (whole and first half)

Bailey, T. Grahame. Urdu : the name and the language. *Journal of the Royal Asiatic Society*, 391-400, 1930. ISIS

« Urdu was born in 1027 ; its birthplace was Lahore, its parent Old Panjabi ; Old Kharî was its stepparent ; it had no direct relationship with Braj. The name Urdu first appears 750 years later. »

Gruner, O. Cameron. Avicenna. A treatise on the Canon of medicine of Avicenna, incorporating a translation of the first book. 612 p. (edition limited to 500 copies). London, Luzac, 1930. ISIS

The purpose of the treatise is two-fold : To furnish a translation of the First Book of the Canon. The section on Anatomy is omitted in favour of the first half of the De viribus cordis. To present a study of its mystical philosophy, especially showing where this and modern biological knowledge are reciprocally illuminative.

Mackinney, Loren C. The people and public opinion in the eleventh century peace movement. *Speculum*, 5, 181-206, 1930. ISIS

Singer, Charles. The dark age of science. *The Realist*, 2, 281-95, London, November 1929. ISIS

Largely a discussion of Byrhtferth's views apropos of S. J. Crawford's edition (1929 ; *Isis*, 14, 474).

XIth Century (second half)

Haskins, Charles H. ALBERICUS CASINENSIS. Estratto da *Casinensia*, 115-24, Montecassino, 1929. ISIS

« Among the men of learning who flourished at Monte Cassino in the later years of the eleventh century, an honorable place belongs to the monk ALBERICUS. According to PETRUS DIACONUS he was the author of saints' lives, sacred verse, sermons, theological and controversial pamphlets, letters, and treatises on rhetoric, dialectic, music, and astronomy, a notable range of literary production, even if we allow something for error and exaggeration, and one that makes us desirous of examining these works themselves. Unfortunately, few of these have survived or, at least, been identified. The library of Monte Cassino now possesses only certain pieces commemorating S. SCOLASTICA and S. DOMENICO OF SORA and the dispute with BERENGARIUS, while various rhetorical works have passed beyons the Alps and become known in part to students of mediaeval literature. Thanks to these, ALBERIC has achieved a position as the pioneer of the new *ars dictaminis* in the form which was to dominate the rhetoric of the twelfth century, and as the teacher of the *cursus* which his pupil JOHN OF GAETA, chancellor of the papal See and later (1118-19) Pope GELASIUS II, seems to have introduced into the Roman curia. »

Willard, H. M. The use of classics in the Flores Rhetorici of ALBERIC OF MONTE CASSINO. HASKINS anniversary essays in mediaeval history, p. 351-63, Boston, 1929. ISIS

For ALBERIC OF MONTE CASSINO, see HASKINS's paper in the Mélanges PIRENNE (1926; *Isis*, 10, 124) or his *Studies in mediaeval culture* (1929).

XIIth Century (whole and first half)

Beddie, James Stuart. Libraries in the twelfth century: their catalogues and contents. HASKINS anniversary essays in mediaeval history, p. 1-23, Boston, 1929. ISIS

Buckler, Georgina. ANNA COMNENA, a study. 558 p. Oxford University Press, 1929. ISIS

Reviewed by HENRI GRÉGOIRE, *Byzantion*, 4, 684-92, 1929. Says the reviewer : « Depuis longtemps, nous n'avons pas pris en main un livre sur Byzance qui nous ait autant ravi. C'est certainement le meilleur, dans tous les sens, qu'on ait jamais écrit sur un écrivain byzantin, au moins depuis le mémoire nonagénaire de PARISOT : CANTACUZÈNE, *homme d'État et historien*. Mrs. GEORGINA BUCKLER avait toutes les qualités requises pour faire ce livre avec succès. Femme d'un érudit infiniment distingué et sympathique, l'archéologue et épigraphiste W. BUCKLER, excellente helléniste et humaniste elle-même, elle s'est éprise depuis longtemps de cette noble et charmante figure de femme savante et passionnée qu'est la fille et panégyriste d'ALEXIS COMNÈNE. Elle connait son œuvre comme personne; mais elle connait aussi tout ce qu'on a écrit sur son héroïne; et elle trahit à chaque page, à chaque

ligne, d'immenses lectures dépassant le cadre de la littérature et de l'histoire byzantines. Elle sait ses classiques grecs aussi bien, et même mieux qu'ANNE. Elle écrit beaucoup mieux qu'elle, et son goût littéraire lui suggère à chaque instant de piquants rapprochements qui font de son brillant essai, une lecture attachante, émouvante, amusante, vivante. »

Comnena, Anna. The Alexiad of the Princess ANNA COMNENA, being the history of the reign of her father, ALEXIUS I, emperor of the Romans, 1081-1118, A.D., translated by ELISABETH A. S. DAWES, 439 p. London, M. A. D. T. ISIS

Reviewed by HENRI GRÉGOIRE, *Byzantion*, 4, 684-92, 1929.

Conant, Kenneth John. Mediaeval Academy excavations at Cluny. *Speculum*, 77-94, 2 pl., 1 fig., 1930. ISIS

David, Charles W. The claim of King HENRY I to be called learned. HASKINS anniversary essays in mediaeval history, p. 45-56, Boston, 1929. ISIS

« It is clear that the value of education was fully appreciated in the Conqueror's family; and it cannot be doubted that HENRY had his opportunity to learn Latin, and that he did acquire a considerable, though by no means a complete, mastery of the language. But it is equally certain that his great fame as a learned king is the product of a later age, not of the age in which he lived. »

Finot, Louis. Le Temple d'Angkor Vat. Première partie. L'architecture du monument. *(Mémoires archéologiques publiés par l'Ecole Française d'Extrême-Orient.)* Deux vol., 41 p., 150 pl. Paris, VAN OEST, 1929. ISIS

Reviewed by J. BACOT, *Journal des Savants*, 43, 1930.

Geoffrey of Monmouth. The Historia regum Britanniae of GEOFFREY OF MONMOUTH. With contributions to the study of its place in early British history by ACTON GRISCOM. Together with a literal translation of the Welsh manuscript no. LXI of Jesus College, Oxford. By ROBERT ELLIS JONES. XIII+672 p. London, LONGMANS, 1929. ISIS

Grégoire, Henri. Notes sur ANNE COMNÈNE. *Byzantion*, 3, 311-17, 1927. ISIS

Lasserre, Pierre. Un conflit religieux au XII^e^ siècle : ABÉLARD contre SAINT BERNARD (l'*Artisan du livre*). ISIS

Levy, Raphael. The position of ABRAHAM IBN EZRA in Judaeo-Romance. *The Jewish Forum*, 16-23, January 1930. ISIS

Vernadskij, G. Relations byzantino-russes au XII[e] siècle. *Byzantion*, 4, 269-76, 1929. ISIS

XIIth Century (second half)

Asín Palacios, Miguel. Practical chemistry in the twelfth century. *Isis*, 13, 358, 1930. ISIS

Corrections to R. STEELE's edition of RASIS *de aluminibus et salibus* (*Isis*, 12, 10-46, 1929; 13, 426).

Bussi, Emilio. Ricordi d'Italia di un viaggiatore arabo del XII secolo. *Rivista Geografica Italiana*, 36, 138-43, 1929. ISIS

On the passages describing Italy in the geographical writings of the Andalusian ABÛ ḤÂMID MUḤAMMAD AL-MAZÎNI (Granada, 1080-81; Damascus, 1169-70), the Arabic text of which was published by GABRIEL FERRAND, *Journal Asiatique*, 207, 1-148, 193-304, 1925 (*Isis*, 11, 424). J. K. W.

John of Salisbury. JOANNIS SARESBERIENSIS Episcopi Carnotensis Metalogicon. Libri IV. Recognovit et prolegomenis, apparatu critico, commentario, indicibus instruxit CLEMENS C. I. WEBB. XXII+239 p. Oxford, Clarendon Press, 1929. ISIS

Reviewed by JOSEPH BALOGH, *Deutsche Literaturzeitung*, 1, 155-56, 1930, and by S. HARRISON THOMSON, *Speculum*, 132-34, 1930.

Liebeschütz, Hans. Das allegorische Weltbild der heiligen HILDEGARD VON BINGEN (*Studien der Bibliothek Warburg*, herausgegeben von FRITZ SAXL, 16). IX+179 p., 6 pl. Leipzig, TEUBNER, 1930 (geheftet, RM. 15). ISIS

Studies on the *Timeus* and the Platonic school of Chartres led the author to investigate the allegorical meaning of HILDEGARD's writings. This had already been done by Dom LOUIS BAILLET from the theological point of view (Paris, 1911), and by CHARLES SINGER from the scientific point of view (Oxford, 1917), not to speak of others, but some reflections of R. REITZENSTEIN in his *Studien zum antiken Synkretismus aus Iran und Griechenland* (1926, p. 138) and the influence of the Warburg group, convinced the author of the necessity of a new and deeper investigation, results of which are here elaborately presented. The table of contents shows the comprehensiveness of his work. I. Formelemente in der theologischen Schriftentrilogie: 1. Die Weltschöpfung als Zeichen der Sündenerlösung; 2. Personifikationen und symbolische Architekturteile; 3. Berufsbewusstsein und Mönchsfrömmigkeit; 4. Visionsbild und Allegorie; 5. Jenseitsbericht. II. Makrokosmos und Mikrokosmos: 1. Die Umrisse des Weltbildes; 2. Die Sphärenkreise der grossen Welt; 3. Windkräfte und Sternenkräfte; 4. Der Kosmosmensch; 5. Die religiöse Sinngebung. III. Weltepochen und Weltende: 1. Die Zeiten des göttlichen Weltregiments; 2. Sünden und Elemente; 3. Adam und die Prophetie; 4. Gegenwartskritik und Apokalyptik; 5. Die Verkündung

der Endzeit. IV. Die Prophetin : 1. Bildungswelt; 2. Die Selbstbeurteilung von Leben und Werk; 3. Die psychophysische Grundlage der Vision.

The admirable illustrations derived from the Wiesbaden and Lucca MSS. already published by BAILLET and SINGER are here once more reproduced; it is pleasant to see them again. G. S.

Meyerhof, Max. Die allgemeine Botanik und Pharmakologie des EDRISI. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 12, 225-36, 1930. ISIS

German translation of part of that treatise from the MS. recently discovered in Constantinople (see the author's earlier paper on the subject, ibidem, 12, 45; *Isis*, 13, 424). Die Einleitung enthält « eine allgemeine Botanik, welche vielfach aristotelische Einflüsse zeigt, für die ich aber eine Vorlage bisher nicht auffinden konnte. Die Botanik des THEOPHRASTOS ist nie in das Arabische übersetzt worden, und mit der Einleitung des pseudo-aristotelischen *De Plantis* stimmt unser Abschnitt nicht überein. Vielleicht ist ein Leser der nachfolgenden Übersetzung desselben imstande, die Herkunft der Darstellung des EDRISI nachzuweisen und an dieser Stelle darüber zu berichten. Denn der Araber fusst nach seiner eigenen Angabe ganz auf antikem Boden; seine wiederholte Erwähnung der Pflanzenseele geht auf ARISTOTELES zurück. » MEYERHOF concludes : « Damit endet die Einleitung von EDRISIS Arzneimittellehre, und nach einer Anrufung Gottes folgt der Hauptteil des Werkes, beginnend mit der Droge ' Absinth '. Soweit ich bisher in die 360 erhaltenen Abschnitte diese Teiles Einsicht gewinnen konnte, finde ich, dass AL-IDRÎSÎ in botanischen Fragen fast überall ein durchaus selbständiges Urteil hat, während er in der Darstellung medizinischer Dinge vorwiegend die Quellen zitiert, welche er selbst im Anfang der Einleitung angeführt hatte, und dazu noch viele andere. Er war eben kein praktischer Arzt (ṭabîb), sondern ein Gelehrter, der sich mit Heilkunde beschäftigte (mutaṭabbib). In ärztlichen Dingen ist ihm sein spanischer Landsmann und Zeitgenosse AḤMAD AL-GHÂFIQÎ weit überlegen, von dessen durch BARHEBRAEUS abgekürzter Pharmakologie soeben hier in Kairo eine prächtige alte Handschrift aufgetaucht ist. Zum Schlusse sei bemerkt, dass sich unter den von EDRISI angeführten Synonymen so häufig neugriechische Drogennamen finden, dass man die Entstehung seiner Heilmittellehre wohl sicher in das höhere Alter des Verfassers, während seines Aufenthaltes in Sizilien (etwa 1150-66 n. Chr.), zu verlegen hat. »

Palmer, H. R. The central Sahara and Sudan in the twelfth century A.D. *Journal of the African Society*, 28, 368-78, 1929. ISIS

Interpretation of the description of the central Sahara and Sudan in the Description of Africa and Spain of AL-IDRÎSÎ, based on the text and translation of R. DOZY and M. J. DE GOEJE, Leiden, 1866. J. K. W.

Post, Gaines. ALEXANDER III, the licentia docendi and the rise of the universities. HASKINS anniversary essays in mediaeval history, p. 255-77, Boston, 1929. ISIS

« In the constitutional history of none of the centers of learning which

developed into Universities at the end of the twelfth century, Bologna, Montpellier, Oxford, and Paris, did ALEXANDER play an important part. His legislation had no application whatever at Bologna and Oxford, and only very indirectly, if at all, at Montpellier. It related to Paris only in so far as schools were episcopal, that is, under the official of the cathedral chapter, the chancellor. ALEXANDER did not, like the popes of the thirteenth century, have a university consciousness. His legislation aimed at stopping feudal practices in the Church, at centralizing papal authority. It purposed also to encourage learning by helping the teachers in episcopal schools, but not, in practice, those in great centers of learning. The prohibition of scholastic simony was enforced locally, at less important centers of learning, at Châlons, Bourges, or Winchester, but not at Paris. The importance of ALEXANDER's control of the chancellor lies in its effect as a precedent on papal regulation of the Universities in the thirteenth century; the chancellor, obliged by ALEXANDER to accept papal interference in his superintendency of the schools, became the representative of the papacy in the University, a development, however, which was completed after the Masters and Students had organized. The cathedral schools—with the sole and qualified exception of Paris, which however, by 1160 was no longer one of the local type—did not become universities; those centers of learning which had their origin in the twelfth century and became Universities developed out of natural conditions of the time which were too strong to be greatly affected by the decrees of ALEXANDER III. »

Usâmah ibn-Munqidh (1095-1188). An Arab-Syrian gentleman and warrior in the period of the crusades. Memoirs of USÂMAH IBN-MUNQIDH (Kitâb al-i'tibâr). Translated from the original manuscript by PHILIP K. HITTI. x+265 p., 4 illus. New York, Columbia University Press, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 365-8, 1930.

Williams, John R. WILLIAM OF THE WHITE HANDS and men of letters. HASKINS anniversary essays in mediaeval history, p. 365-87, Boston, 1929. ISIS

Apropos of GUILLAUME AUX BLANCHES MAINS, bishop of Chartres, archbishop of Rheims from 1167 to 1202; patron of men of letters. G. S.

XIIIth Century (whole and first half)

Bémont, Charles. SIMON DE MONTFORT, earl of Leicester, 1208-1265. A new edition translated by E. F. JACOB. xxxi+303 p. Oxford, Clarendon Press, 1930. ISIS

Bratianu, G. I. Recherches sur le commerce génois dans la Mer Noire au XIII^e siècle. 359 p., 5 pl., 1 map. Paris, GEUTHNER, 1929. ISIS

Delorme, Ferdinand M. La « Legenda antiqua S. Francisci », texte

du Ms. 1046 (M. 69) de Pérouse. Edité par FERDINAND-M. DELORME. XXI+70 p. Paris, Éditions de la « France Franciscaine », 1926. ISIS

Reviewed by JEANNE ODIER, *Bibliothèque de l'École des Chartes*, 89, 107-08, 1928.

Heller, Emmy. Die « ars dictandi » des THOMAS VON CAPUA (gest. 1239). Kritisch erläuterte Edition. 59 p. *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, philosophisch-historische Klasse*, Jahrgang 1928-29, 4. Abhandlung, 1929. ISIS

al-Khuwayyî, Abul 'Abbâs Aḥmad b. al-Khalîl (1187-1239). As-safînat an-nûḥiyya fî-s-sakînat ar-rûḥiyya. 4-34 p. Ḥalab, 1347 (1929). ISIS

Reviewed by F. KRENKOW, *Journal of the Royal Asiatic Society*, 483-84, 1930.

La Monte, John L. The communal movement in Syria in the thirteenth century. HASKINS anniversary essays in mediaeval history, p. 117-131, Boston, 1929. ISIS

Landgraf, Artur. Der Traktat « De errore Pelagii » des WILHELM VON AUVERGNE. *Speculum*, 5, 168-80, 1930. ISIS

Renaud, H. P. J. Aperçu sur la géographie scientifique des Arabes. *Bulletin de l'enseignement public*, 14 p., map, Paris, 1927. ISIS

Deals mainly with the Moroccan mathematician and astronomer, ABÛ 'ALÎ AL-ḤASAN AL-MARRÂKUSHÎ. RENAUD concludes : « Ainsi, les progrès accomplis par les Arabes d'Occident dans la rectification des coordonnées géographiques, fort honorables au point de vue des latitudes sont tout-à-fait remarquables dans la correction des longitudes. Que celle-ci ait été obtenue principalement au moyen d'itinéraires, c'est ce que l'examen des tables d'EL MARRAKCHI semble démontrer; il était difficile de faire mieux à une époque où, malgré les perfectionnements apportés par les Arabes à l'instrumentation des Grecs, le problème de la conservation de l'heure au moyen du pendule n'était qu'entrevu avec IBN YOUNIS (XI^e siècle) et celui de son transport tout-à-fait ignoré ».

Singer, Dorothea Waley. MICHAEL SCOT and alchemy. *Isis*, 13, 5-15, 1929. ISIS

« Professor HASKINS has drawn attention in *Isis* to an alchemical treatise attributed to MICHAEL SCOT. It gives an interesting picture of the co-operation of Latins, Hebrews and Saracens in the practice of alchemy. Professor HASKINS cites XIV and XV century copies of this treatise. There is, however a XIII century version at Caius College, Cambridge. This, though showing considerable divergences from the Palermo and Oxford versions used by Prof. HASKINS, takes back the attribution of alchemy to

MICHAEL SCOT to something like a contemporary date. Like the later manuscripts, however, the Caius version suggests a compilation from various writers, including MICHAEL SCOT himself. Yet another excerpt of the XV century suggests one GULIELMUS PARISIENSIS as the compiler. » An extract from the Cambridge MS. is quoted in appendix (p. 12-14).

XIIIth Century (second half)

Bacon, Roger. Opera hactenus inedita facsc. IX. De retardatione accidentium senectutis cum aliis opusculis de rebus medicinalibus, nunc primum ediderunt A. G. LITTLE, E. WITHINGTON. XLIV+ 224 p. Oxford, Clarendon Press, 1928. ISIS

Reviewed by LYNN THORNDIKE, *Isis*, 13, 110-11, 1929.

Balss, Heinrich. ALBERTUS MAGNUS als Zoologe. 155 p., 1 pl., 20 fig. (*Münchener Beiträge z. Gesch. u. Lit. d. Naturwiss. u. Medizin*, H. 11-12). München, Verlag der Münchner Drucke, 1928. ISIS

Elaborate study of ALBERT's zoology based on STADLER's excellent edition of it. An introductory chapter explains briefly the development of zoology down to ALBERT's time, analyzes his work, and discusses his sources. Then follow a series of chapters dealing respectively with ALBERT's taxonomy, anatomy, physiology, procreation, development and heredity, human procreation, teratology, ecology, animal geography, astrology, husbandry, hunting and fishing. No index! Animal psychology has been left out because of the existence of a thesis on the subject by J. PEITZMEIER (Inaug. diss., Münster i.W., 1923; unpublished).

The author concludes « ALBERTUS sah und beobachtete auf seinen Reisen alles, was es zu beobachten gab, vom unscheinbaren Schwamme und dem Regenwurme an bis zu den höchsten Tieren hinauf, den Vögeln und Säugetieren, zu denen er auch den Menschen als das perfectissimum animal rechnete und dessen Lebensäusserungen er als echter Biologe—wie sein Meister ARISTOTELES—mit denen der Tiere fortwährend in Parallele setzte. Die vielen eigenen Beobachtungen die er so auf den Gebieten der Anatomie, Teratologie und vor allem der Ökologie machte, konnte der Leser in den betreffenden Kapiteln dieses Buches bewundern. Nicht so selbständig tritt uns ALBERT dagegen als Theoretiker entgegen. Hier folgt er vollkommen seinem Meister ARISTOTELES oder auch dem von ihm ebenso hoch geschätzten AVICENNA; was er diesen beiden hinzufügt, wie die öftere Heranziehung der Astrologie, lag im Geiste des Zeitalters begriffen und ist nicht originell. »

G. S.

Damon, S. Foster. A portrait of ALBERTUS MAGNUS. *Speculum*, 102, port., 1930. ISIS

Ghellinck, Joseph de. JOHN OF MONTE-CORVINO, first archbishop of Pekin in the fourteenth century. *International Review of Missions*, 18, 83-96, 1929. ISIS

Gilson, Etienne. The philosophy of ST. THOMAS AQUINAS. Authorized translation from the third revised edition of Le Thomisme. XV+372 p. Cambridge, HEFFER, 1930. ISIS

Jalâlu'd-dîn Rûmî. The Mathnawî of JALÂLU'D-DÎN RÛMÎ. Edited from the oldest manuscripts available with critical notes, translation, and commentary, by R. A. NICHOLSON. Vol. 3, containing the text of the Third and Fourth Books. XXXI+64+510 p. (*Gibb Memorial Series*, new series, IV, 3). London, LUZAC, 1929. ISIS

Reviewed by C. N. S., *Journal of the Royal Asiatic Society*, 127-31, 1930.

Schaefer, Romanus Johannes. Starlehre und Staroperation bei den mittelalterlichen Chirurgen im Abendlande. GEORG STICKER Festgabe, 49-53, Berlin, SPRINGER, 1930. ISIS

Deals mainly with LANFRANCHI of Milan. The author concludes : « Das, was wir in dieser Abhandlung LANFRANCHIS besonders historisch interessant finden, ist die Anwendung der Pupillenreaktion bei der Indikation zur Staroperation schon 1296, sicherlich schon weit früher. Ich finde dieselbe Beschreibung von der Pupillenreaktion beim Star auch in der Chirurgie von BRUNO VON LONGOBURGO (1252) und auch später bei GUY DE CHAULIAC (1363). »

Seemann, Hugo J. Die Instrumente der Sternwarte zu Marâgha nach den Mitteilungen von AL 'URḌI. Sonderabdruck aus den *Sitzungsberichten der Physikalisch-medizinischen Sozietät zu Erlangen*, Band 60, 15-126, Erlangen, 1928. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 111-13, 1929.

Toynbee, Margaret R. ST. LOUIS OF TOULOUSE and the process of canonization in the fourteenth century. IX+266 p. Manchester, University Press, 1930. ISIS

Trummeter, Fritz (gest.) IBN SA'ID's Geschichte der vorislamischen Araber. 67 p. Stuttgart, KOHLHAMMER, 1928. ISIS

Reviewed by W. CASKEL, *OLZ*, 33, 129, 1930.

Vacca, Giovanni. Le divisament dou monde ossia la descrizione del mondo, di MARCO POLO. *Rivista Geografica Italiana*. 35, p. 51-60, 1928. ISIS

Discussion of texts of MARCO POLO inspired by the recent edition of BENEDETTO (*Isis*, 11, 135-38).

Zapelloni, Maria Teresa. Il postulato di CAMPANO e i fondamenti dell' aritmetica. *Periodico di matematiche*, 8, 175-84, 1928. ISIS

XIVth Century (whole and first half)

Auerbach, Erich. DANTE als Dichter der irdischen Welt. Berlin, DE GRUYTER, 1929. ISIS

Bacher, W. Aus der Bibelexegese JOSEPH IBN KASPIS. *Monatschrift für die Geschichte und Wissenschaft des Judentums*, 56, 199-217, 324-33, 449-57, 1912 ; 57, 559-66, 1913. A. M. ISIS

Brandt, Walther I. PIERRE DUBOIS : modern or medieval ? *American Historical Review*, 35, 507-21, 1930. ISIS

« With the exception of his definite plan for a court of international arbitration and the proposal for a system of schools regularly admitting women to professional training, nearly all of DUBOIS's ideas can be found in the writings of his contemporaries and predecessors. This does not imply that he was a mere plagiarist or that he was devoid of originality. It does show, however, that these ideas were not unknown in his time, even though he may have arrived at many of his conclusions independently. None of his contemporaries, not excepting ROGER BACON, displayed such catholicity of interest. DUBOIS's title to fame rests principally on the fact that he absorbed ideas previously expressed by others, elaborated on some of them, and combined the whole into a unified system. A thirteenth century lawyer, representative of his age, he attempted to solve the problems of his day in much the same spirit in which similar problems of our day are being met by the men of our own generation. »

Dalorto, Angellino de. Royal Geographical Society. Reproductions of early manuscript maps, 1 : the Portolan chart of ANGELLINO DE DALORTO, MCCCXXV, in the collection of Prince CORSINI at Florence. With a note on the surviving charts and atlases of the fourteenth century, by ARTHUR R. HINKS. Memoir. 12 p., chart in 4 sheets. London Royal Geographical Society, 1929. ISIS

Reviewed in *Geographical Review*, 20, 340, 1930, and in *Nature*, 125, 486-87, 1930.

Falco, Vittorio de. Altri scolii di GIOVANNI PEDIASIMO agli Analitici. *Byzantinische Zeitschrift*, 28, 251-69, 1928. ISIS

Guilland, Rodolphe. Les poésies inédites de THÉODORE MÉTOCHITE. *Byzantion*, 3, 265-302, 1927. ISIS

Leigh, Gertrude. New light on the youth of DANTE. The course of DANTE's life prior to 1290 traced in the Inferno cantos 3-13. VIII+278 p. London, FABER and FABER, 1930. ISIS

Magnaghi, Alberto. Questioni di geografia Dantesca. *Rivista Geografica Italiana*, 35, 195-205, 1928. ISIS

Discussion of a perplexing question raised by a passage in the *De vulgari eloquentia* (I, VIII, 8) describing the boundaries of the dialectical territories in which oc, oil, and si are used. MAGNAGHI holds that DANTE must have been familiar with the relatively accurate outlines of Italy as shown on the portolan charts of the period. J. K. W.

Pelzer, Auguste. PROSPER DE REGGIO EMILIA des Ermites de Saint-Augustin et le manuscrit latin 1086 de la bibliothèque Vaticane. p. 316-51. (Extrait de la *Revue néo-scolastique de philosophie*, août, 1928). Louvain, Institut supérieur de philosophie, 1928. ISIS

Reviewed by JEANNE ODIER, *Bibliothèque de l'École des Chartes*, 89, 396-97, 1928.

Simonini, R. II codice di Mariano di SER JACOPO sopra « Rimedi abili nel tempo di pestilenza ». *Boll. Ist. Stor. Ital. Arte Sanit.*, 9, 161-69, 1929. ISIS

Sudhoff, Karl. Mittelalterliche Einzeltexte zur Beulenpest vor ihrem pandemischen Auftreten 1347/48. GEORG STICKER Festgabe, 39-48, Berlin, SPRINGER, 1930. ISIS

XIVth Century (second half)

Gál, Alexandre. Die « Summa legum », brevis, levis et utilis. Vol. I. IV+406 p. Weimar, BOHLAU, 1926. ISIS

Reviewed by PAUL FOURNIER, *Bibliothèque de l'École des Chartes*, 89, 103-04, 1928.

Golubovich, Girolamo. Biblioteca bio-bibliografica della Terra santa e dell' Oriente francescano. Tomo V (dal 1346 al 1400). XII+441 p. Firenze, Collegio di S. Bonaventura, 1927. ISIS

Reviewed by H. O., *Bibliothèque de l'École des Chartes*, 89, 109, 1928.

Griffin, Nathaniel Edward; Myrick, Arthur Beckwith. The Filostrato of GIOVANNI BOCCACCIO. A translation with parallel text. With an introduction by NATHANIEL EDWARD GRIFFIN. IX+505 p. Philadelphia, University of Pennsylvania Press, 1929. ISIS

Reviewed by C. H. GRANDGENT, *Speculum*, 115, 1930.

Power, Eileen. The goodman of Paris (le ménagier de Paris), a treatise of moral and domestic economy by a citizen of Paris (c. 1393), now first translated into English with an introduction and notes. 348 p., 16 pl. London, 1928. ISIS

Reviewed by A. C., *Journal des Savants*, 39-40, 1930.

Shannon, Edgar Finley. CHAUCER and the Roman poets. XXII+401 p. Cambridge, Mass., Harvard University Press, 1929. ISIS

Wyclif. Select English writings. Edited by HERBERT E. WINN. With a preface by H. B. WORKMAN. XL+179 p. Oxford, University Press, 1930. ISIS

XVth Century (whole and first half)

Albo, Joseph. Sefer ha-'iqqarim. Book of principles. Critically edited on the basis of manuscripts and old editions, and provided with a translation and notes by ISAAC HUSIK. Vol. 1, XXVIII+409 p. Vol. 2, 438 p. Vol. 3, 702 p. Philadelphia, Jewish Publication Society of America, 1929-1930. ISIS

Bouvier, René. Un financier colonial au XV^e^ siècle, JACQUES CŒUR, Paris, 1929. ISIS

Reviewed by CH. DE LA RONCIÈRE, *Larousse mensuel*, 8, 154-55, 1929.

Burckhardt, Jacob. The civilization of the Renaissance in Italy. Authorized translation from the fifteenth edition, by S. G. C. MIDDLEMORE. 527 p. London, HARRAP, 1929. ISIS

See *Isis*, 11, 553.

Hoffmann, Ernst; Klibansky, Raymond. CUSANUS-Texte. 1. Predigten. 1. « Dies Sanctificatus » vom Jahre 1439. Lateinisch und deutsch mit Erläuterungen. 56 p., 1 pl. *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, philosophisch-historische Klasse*, Jahrgang 1928-29. 3. Abhandlung, 1929. ISIS

Horák, Boh. Svetová mapka v rukopise Vavrincovy Kroniky svetové. *Sborník Ceskoslovenské Spolecnosti Zemepisné*, 33, 223-26, 1927. (Résumé in French). ISIS

The French résumé states that this article « contient le rapport et la description d'une mappemonde de la forme TO dans un manuscrit tchèque du commencement du 15^e^ siècle, ' Kronika svetová ' par VAVRINEC de Brezová. »
J. K. W.

Maqrîzî. El mawâ'iz wa-l- i'tibâr fî dkikr el-khiṭaṭ wa-l âthâr. Arabic text edited by GASTON WIET. Vol. 5, fascicule premier. 184 p. *Mémoires publiés par les membres de l'Institut français d'archéologie orientale du Caire*. Tome 53, 1927. ISIS

Reviewed by A. R. GUEST, *Journal of the Royal Asiatic Society*, 140, 1930.

Nicolas de Cusa. *De la docte ignorance*. Traduction de L. MOULINIER.

Introduction par ABEL REY (Coll. *Textes et traductions pour servir à l'histoire de la pensée moderne*, dirigée par ABEL REY) 230 p., Paris, ALCAN, 1930 (20 fr.). ISIS

Première traduction française, établie sur l'édition critique de PAOLO ROTTA (LATERZA, Bari, 1913), des trois livres du *De docta ignorantia* (1440), l'œuvre la plus intéressante de NICOLAS DE CUSA. Seuls avaient été traduits en français la *Coniectura de ultimis diebus*, par F. BOHIER, 1562 (réimpression en 1700 et 1733), et le *De visione Dei*, par DE GOLEFER, 1630. Dans la *docte ignorance* (ignorance consciente) — expression qu'il reprend de BONAVENTURE — NICOLAS oppose à la scolastique une sorte de néoplatonisme teinté de pythagorisme (presque tout le I^er^ livre est mathématique). Dans l'introduction qui précède la traduction de MOULINIER, ABEL REY donne en un raccourci extrêmement serré, l'essentiel de la position philosophique de NICOLAS DE CUSA. L. G.

Nicholas of Cusa. The vision of God. Translated by EMMA GURNEY SALTER. With an introduction by EVELYN UNDERHILL. XXX+130 p. London, DENT, 1928. ISIS

Ritter, Joachim. Docta ignorantia. Die Theorie des Nichtwissens bei NICOLAUS CUSANUS. 111 p. Leipzig, TEUBNER, 1927. ISIS

Reviewed by ERNST HOFFMANN, *Deutsche Literaturzeitung*, 6, 2092-93, 1929.

Schwahn, Walther. Laurentii Vallae de falso credita et ementita Constantini donatione declamatio. XXIV+82 p. Leipzig, TEUBNER, 1928. ISIS

Reviewed by A. D. FRASER, *Speculum*, 5, 234-5, 1930.

Taeschner, Franz. Der Bericht des arabischen Geographen IBN AL-WARDI über Konstantinopel. *Beiträge zur historischen Geographie, Kulturgeographie, Ethnographie und Kartographie*, vornehmlich des Orients, hrsg. von HANS MZIK, p. 84-91. Leipzig and Vienna, DEUTICKE, 1929. ISIS

IBN AL-WARDI (d. 1457) in his geographical treatises gives the last pre-Turkish description of Constantinople. Although representing a stereotyped view of the city repeated by many earlier writers, it is of interest because of its relative completeness and is given here in German translation with commentary. J. K. W.

Thorndike, Lynn. GIOVANNI DE' FONTANA. *Isis*, 13, p. 103, 1929. ISIS

Wickersheimer, Ernest. Une liste, dressée au XV^e^ siècle, des commentateurs du premier livre du canon d'AVICENNE et du livre des aphorismes d'HIPPOCRATE. *Janus*, 34, 33-7, 1930. ISIS

Zakythinos, D. A. Poèmes inédits de CIRIACO D'ANCONA. (Avec une épigramme de THÉODORE GAZA). *Byzantinische Zeitschrift*, 28, 270-72, 1928. ISIS

XVth Century (second half)

Almagià, Roberto. Le prime conoscenze dell'America e la cartografia italiana. *Atti del XXII Congresso Internazionale degli Americanisti*, Roma, Settembre 1926. II, 589-92, Rome, 1928. ISIS

Altolaguirre, Angel de. Autenticidad de la escritura de Mayorazgo en la que Don CRISTOBAL COLON declaro haber nacido en Genova. *Atti del XXII Congresso Internazionale degli Americanisti*, Roma, Settembre 1926. II, 593-602, Rome, 1928. ISIS

Biel, Gabriel (c. 1430-1495). Treatise on the power and utility of moneys by Master GABRIEL BIEL of Speyer, a very excellent man and profound thinker, licentiate in the most sacred letters, lecturer ordinarius with the courage of his convictions at the famous University of Tübingen, while he was in the world. Lately done into English by ROBERT BELLE BURKE for JOSIAH HARMAR PENNIMAN, provost of the University of Pennsylvania : and to be sold by the University of Pennsylvania Press in Philadelphia, and in London by the Oxford University Press. 39 p. 1930 ($ 2.50). ISIS

A charming little book containing the first English translation of BIEL's *Tractatus de potestate et utilitate monetarum*, the original of which was first published at Nuremberg, 1542. This was truly a pioneer work on the subject. To be sure ORESME's treatise *De origine, natura, jure et mutationibus monetarum* was a century earlier and remarkable in many respects, which is not surprizing, for ORESME was a man of genius, far greater than BIEL. And yet he was still so much dominated by Aristotelian and Thomist prejudices on the subject that his fundamental conception of money was wrong. « There are in my opinion », said he « three ways in which a man can make a profit in money, apart from its natural use : the first is by the money-changer's art, the custody of moneys and traffic therein; the second is by usury; and the third is by changing the monetary standard. The first method is petty, the second evil, and the third worse. » It is rather amusing that all those schoolmen who found it so wicked to lend money at interest, had no objection to the renting of a house, which amounted to the same thing. It may interest historians of science to know that the next great writer on money after ORESME and BIEL, was COPERNICUS who wrote a treatise entitled *Monetae cudendae ratio*. Both BIEL and COPERNICUS left quietly aside the old doctrine of the sterility of money. To return to BIEL's work, Dean BURKE remarks « Both in its form and in its subject matter it shows the direct influence of ORESME's remarkable work. BIEL, however, is more concise than ORESME in the presentation of his theme. He bases his reasoning on the broad principles of canon law, employs the language of formal logic in developing

his subject, and draws conclusions that appeal to the common sense of the reader as sound in every particular. » As to BIEL himself, ultimus scholasticorum « he was born at Speyer about 1430. He studied at Heidelberg and held a pastoral charge for some time at Mainz. He then took an active part in the work of a religious order known as the Brethren of the Common Life at Butzbach and later at Urach, where he won the confidence of Duke EBERHARD VON WÜRTEMBERG. In 1484 he was appointed professor of philosophy and theology in the newly founded University of Tübingen. Towards the end of his life he retired into a house of Canons Regular where he died in 1495. » G. S.

Carreras i Valls, R. La descoberta d'Amèrica (FERRER, CABOT i COLOM). Proleg de LUIS ULLOA. 276+3 p., illus., Reus, ROCA, 1928. ISIS

Aims to prove that COLUMBUS and the CABOTS were Catalans. J. K. W.

Carreras i Valls, R. Catalunya descorbridora d'America. Barcelona, ALTÉS, 1930. ISIS

Chalcocandyles, Laonicos. LAONICI CHALCOCANDYLAE historiarum demonstrationes ad fidem codicum recensuit, emendavit, annotationibusque criticis instruxit EUGENIUS DARKO. T. 1 (1. I-IV), T., 2, pars prior (1. V-VIII), pars posterior (1. VIII-X). Budapest, Hungarian Academy, 1922-1923-1927. ISIS

Commynes. PHILIPPE DE COMMYNES. Mémoires, édités par JOSEPH CALMETTE, avec la collaboration du chanoine G. DURVILLE. T. 3 : 1484-1498. 442 p. (*Les classiques de l'Histoire de France au moyen âge*, publiés sous la direction de LOUIS HALPHEN, n° 6). Paris, CHAMPION, 1925. ISIS

Reviewed by CH. SAMARAN, *Bibliothèque de l'École des Chartes*, 88, 107-08, 1927.

Consentius, Ernst. Die Typen der Inkunabelzeit. Eine Betrachtnug. 160 p. Berlin, DE GRUYTER, 1929. ISIS

Reviewed by KARL SCHOTTENLOHER, *Deutsche Literaturzeitung*, 1, 49-51, 1930.

Cortesao, Jaime. Le traité de TORDESILLAS et la découverte de l'Amérique. Conditions physiques, scientifiques et économiques qui ont pu influencer la découverte de l'Amérique. *Atti del XXII Congresso Internazionale degli Americanisti*, 2, 650-83, Rome, 1928. ISIS

See *Isis*, 10, 138. J. K. W.

Crotch, W. J. B. The prologues and epilogues of WILLIAM CAXTON.

CLXIII+115 p. For the Early English Text Society. Oxford, University Press, 1928. ISIS

Delaunay, Paul. Pédiatrie d'antan, un bulletin de santé du dauphin CHARLES ORLAND. *Bulletin de la Société française d'histoire de la médecine*, 23, 356-58, 1929. ISIS

Ehingen, Jörg von. The diary of JÖRG VON EHINGEN. Translated and edited by MALCOLM LETTS. Oxford University Press, 1930. ISIS

JÖRG VON EHINGEN, a knight of Swabia in Germany, set out on his travels about 1451. He visited Cyprus and the Holy Land, Spain and Portugal, France and Scotland. Everywhere he was received at Court, and from Spain he went on with an expedition to Morocco, where outside the walls of Ceuta he fought a successful hand to hand duel with a Moorish champion. Back in Germany, he wrote a narrative of what he had seen and done, and he had it illustrated with twelve portraits of the sovereigns at whose courts he had been entertained. The manuscript is at present at Stuttgart; and it is here translated into English, complete with portraits which as far as is known have never before been photographically reproduced as a whole.

Ellenbog, Ulrich. Von den gifftigen besen Tempffen und Reuchen. Eine gewerbe-hygienische Schrift des XV. Jahrhunderts. XXIV+8 p., 1 fig., facs. (Wiedergabe des ersten Augsburger Druckes mit Biographie und einer medizin- und druckgeschichtlichen Würdigung von FRANZ KOELSCH und FRIEDRICH ZOEPFL. II. Sonderheft). Augsburger Druck, 1927. ISIS

Facchinetti, P. Vittorino. CHRISTOFORO COLOMBO e i figli del Poverello di Assisi. *Atti del XXII Congresso Internazionale degli Americanisti*, Roma, Settembre, 1926. II, 697-709, Rome, 1928. ISIS

Fava, Domenico; Montagnani, Carlo. Mostra Colombiana e Americana della R. Biblioteca Estense. Documenti e edizioni a stampa esposte dal R. Archivio di Stato e dalla R. Biblioteca Estense di Modena nell' Anniversario della scoperta dell' America. 108 p. Modena, Soc. tip. Modenese, 1925. ISIS

Reviewed by E. G. LÉONARD, *Bibliothèque de l'École des Chartes*, 89, 405, 1928.

Gray, Howard L. Greek visitors to England in 1455-1456. HASKINS anniversary essays in mediaeval history, p. 81-116, Boston, 1929. ISIS

Jane, Cecil. The letter of COLUMBUS announcing the success of his

first voyage. *Hispanic American Historical Review*, 10, 33-50, 1930. ISIS

Jugie, R. P. GEORGES SCHOLARIOS, œuvres complètes. *Byzantion*, 4, 601-37, 1929. ISIS

Lippmann, E. O. von. Eine deutsche Rohrzuckerfabrik im 15. Jahrhundert. *Zbl. Zuckerindustrie*, 37, 1929. ISIS

Magnaghi, A. AMERIGO VESPUCCI. *Atti del XXII Congresso Internazionale degli Americanisti*, Roma, Settembre, 1926, I, 73-96, Rome, 1928. ISIS

Magnaghi, Alberto. « El inicuo VESPUCIO ». *Rivista Geografica Italiana*, 36, 101-24, 1929. ISIS

Defense of VESPUCCI's honesty, good faith, etc., against the recent attacks of the Peruvian scholar LUIS ULLOA. J. K. W.

Misciattelli, Piero. SAVONAROLA. XI+218 p. English version by M. PETERS-ROBERTS. XI+218 p. Cambridge, HEFFER, 1929. ISIS

Mohler, Ludwig. Kardinal BESSARION als Theologe, Humanist und Staatsmann. Funde und Forschungen. I. Band, Darstellung. VIII+432 p. (*Quellen und Forschungen a. d. Gebiete der Geschichte*, hrsg. v. d. Görres-Gesellschaft, XX. Band). Paderborn, SCHÖNINGH, 1923. ISIS

Reviewed by SEBASTIAN MERKLE, *Byzantinische Zeitschrift*, 29, 66-75, 1929.

Nothafft, A. v. Von Funden mittelalterlicher Syphilis. *Dermatologische Wochenschrift*, 87, 944-52 ; 990-99 ; 1434-1444, 1928. ISIS

Pico della Mirandola, Gianfrancesco. On the imagination. The Latin text, with an introduction, an English translation and notes by HARRY CAPLAN. X+102 p. (Cornell Studies in English, vol. 16). Published for Cornell University. New Haven, Yale University Press, 1930. ISIS

Ritter, Gerhard. Studien zur Spätscholastik, III. Neue Quellenstücke zur Theologie des JOHANN VON WESEL. 105 p. *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, philosophisch-historische Klasse*, Jahrgang 1926-27. 5. Abhandlung, 1927. ISIS

Rohr, Christine. Neue Quellen zu den Entdeckungsfahrten der Portugiesen im Indischen Ozean. *Beiträge zur historischen Geo-*

graphie, Kulturgeographie, Ethnographie und Kartographie, vornehmlich des Orients, hrsg. von HANS MZIK, p. 77-83, 1 illus. Leipzig, DEUTICKE, 1929. ISIS

On a MS. in the National Library, Vienna, containing two hitherto unnoticed accounts of VASCO DA GAMA's second voyage to the Indian Ocean. One account constitutes the only known Portuguese source for this voyage; the other is in German. J. K. W.

Ruppel, Aloys. Mainz als GUTENBERGstadt. 21 p. Mainz, Gutenberg, 1928. ISIS

Reviewed by ALOYS BÖMER, *Deutsche Literaturzeitung*, 6, 2137, 1929.

Schadelbauer, Karl. Ein Sittlichkeitsskandal im Frauenhaus zu Chur vom Jahre 1471. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 206-07, 1930. ISIS

Schefold, Max. Das mittelalterliche Hausbuch als Dokument für die Geschichte der Technik. *Beiträge zur Geschichte der Technik und Industrie*, 19, 127-32, 12 fig., Berlin, 1929. ISIS

« Das Mittelalterliche Hausbuch, das sich im Besitze des Fürsten Waldburg-Wolfegg-Waldsee befindet, stellt eines der wertvollsten und bedeutsamsten kulturgeschichtlichen Dokumente des späten 15. Jahrhunderts dar. Der Name des zwischen 1470 und dem Beginn des 16. Jahrhunderts vornehmlich am Mittelrhein tätigen Meisters, der es geschaffen, ist uns nicht überliefert; die Kunstwissenschaft, die ihn mit dem ' Meister des Amsterdamer Kabinetts' gleich erachtet, pflegt ihn kurz den ' Hausbuchmeister ' zu nennen, als der er uns neben DÜRER und SCHONGAUER als der bedeutendste Vertreter der deutschen Stecherkunst des 15. Jahrhunderts entgegentritt. Durch seine Freiheit in Form und Anschauung, durch die Selbstverständlichkeit und frische Unbefangenheit, mit der er das Charakteristische seiner Zeit erfasst und es dank seinem klaren Blick für alles Wissenswerte und seiner reichen Kenntnis des Lebens wiederzugeben vermag, steht er seinen Zeitgenossen weit voran. Durch geschichtliche Andeutungen ist für die Entstehung des Hausbuchs eine zeitliche Festsetzung gegeben, nämlich das Jahr 1482, was mit der Feststellung, dass der Hausbuchmeister in Speyer weilte, in Einklang steht. »

Strieder, Jacob. Die Entstehung eines deutschen Frühkapitalistischen Montanunternehmertums im Zeitalter JACOB FUGGER des Reichen (1459-1525). *Beiträge zur Geschichte der Technik und Industrie*, 19, 1-12, 7 fig., Berlin, 1929. ISIS

William de Machlinia. The primer on vellum printed by him in London about 1484. Newly found and described by GEORGE SMITH. 26 p., 9 pl. London, ELLIS, 1930. ISIS

Ziesemer, Walther. Studien zur mittelalterlichen Bibelübersetzung.

p. 367-84. (*Schriften d. Königsb. Gelehrt. Ges.* 5. Jahrg. H. 5.). Halle, NIEMEYER, 1928. ISIS

Reviewed by GUSTAV EHRISMANN, *Deutsche Literaturzeitung*, 6, 1771, 1929.

Leonardo da Vinci.

N. B. — Practically al the items mentioned in this bibliography are reviewed, some of them at considerable length, by ETTORE VERGA in his *Raccolta Vinciana*, vol. 13 (Milano, Castello Sforzesco, 1930), which is itself reviewed in *Isis*, 15, 174.

Baratta, Mario. LEONARDO DA VINCI e le paludi pontine. *La geografia*, p. 21, Novara, 1928. ISIS

Bertacchi, Cosimo. LEONARDO DA VINCI matematico, fisico, filosofo della natura, fondatore della scienza della terra. *Rassegna italiana*, p. 391-406, Roma, 1928. ISIS

Bilancioni, Guglielmo. Le leggi del volo degli uccelli secondo LEONARDO. 31 p., fig. Pisa, PACINI, 1927. ISIS

Carusi, Enrico. Sulla redazione abbreviata del Trattato della pittura di LEONARDO DA VINCI (A proposito di un nuovo manoscritto). *Academie e biblioteche d'Italia*, 1, 11-24, fig., Roma, 1928. ISIS

Castaldi, Luigi. La figura umana in LEONARDO DA VINCI (con 36 figure). 48 p. Siena, Stabilimento arti grafiche S. Bernadino, 1927. ISIS

Clark, Pierce L. A psychological study of art vs. science as illustrated in LEONARD DA VINCI. *Archives of Psychoanalysis*, 1, 531-560, 1927. ISIS

Disselhorst, Rudolf. Das biologische Lebenswerk des LEONARDO DA VINCI. *Leopoldina*, 5, 50-75, 1929. ISIS

Favaro, Giuseppe. La mano « stanca » di LEONARDO. Orazione tenuta nell' Aula Magna della R. Università di Modena il 10 Novembre 1929. 8 p. Estratto dall' *Annuario della R. Università di Modena*, Anno 1929-1930, VIII dell' Era fascista. ISIS

Favaro, Giuseppe. L'equilibrio del corpo umano negli studi di LEONARDO. *Atti del R. Ist. Veneto di Scienze Lettere ed Arti*, 86, 228-54, 30 fig., 1926-1927. ISIS

Giacomelli, R. La forma di migliore penetrazione secondo LEONARDO.

Atti della prima settimana aerotecnica, Roma, 23-29 novembre, 11 p., Pisa, 1925. ISIS

Giacomelli, R. LEONARDO DA VINCI e il volo meccanico. *L'aerotecnica*, 486-524, fig., Pisa, 1927. ISIS

Giacomelli, R. Il volo degli uccelli in due recenti pubblicazioni vinciane. *Rivista di aeronautica*, 30 p., fig. Roma, 1927. ISIS

Giacomelli, R. Dispositivi per il controllo laterale e l'aumento della portanza nell'ala dell'aeroplano e dell'uccello. *L'aerotecnica*, 40-58, fig., Pisa, 1927. ISIS

Giacomelli, R. Les machines volantes de LÉONARD DE VINCI et le vol à voile. Extr. du tome 3 des *Comptes rendus du* 4^{me} *Congrès de navigation aérienne* tenu à Rome du 24 au 29 octobre, 1927. 11 p., ill. Roma, 1928. ISIS

Herzfeld, Marie. LEONARDO DA VINCI. Der Denker, Forscher und Poet. Aus seinen veröffentlichten Schriften. Vierte veränderte Auflage. VIII+269 p., ill. Jena, DIEDERICHS, 1926. ISIS

Hildebrandt, Edmund. LEONARDO DA VINCI. Der Künstler und sein Werk. XV+351 p., 296 fig. Berlin, GROTHE, 1927. ISIS

Leonardo da Vinci. Reale commissione vinciana. I fogli mancanti al codice di L. da V. sul volo degli uccelli nella Biblioteca Reale di Torino. A cura di ENRICO CARUSI. XIV+8+8 p., 9 pl. Roma, DANESI, 1926. ISIS

Leonardo da Vinci. I manoscritti e i disegni pubblicati dalla Reale commissione vinciana sotto gli auspici del Ministero della Pubblica Istruzione : Disegni, fasc. I, 23 p., 32 pl., Roma, DANESI, 1928. ISIS

Marcolongo. Roberto. I centri di gravità dei corpi negli scritti di LEONARDO DA VINCI. *Raccolta Vinciana*, fasc. XIII, 99-113, 1930. ISIS

Marcolongo, Roberto. La dinamica di LEONARDO DA VINCI. *Scientia*, 47, 1-8, 1930 ; trad. franç., id., supplém., 1-10. ISIS

LÉONARD avait parfaitement atteint la loi de l'inertie; pour ce qui concerne la relation entre l'espace et le temps, il ne sait pas se libérer de la loi de la dynamique aristotélicienne; quant à la loi de l'action et de la réaction, elle

a été observée et énoncée par L. dans de multiples cas qui intéressent les applications. Dans le mouvement d'un grave libre ou sur un plan incliné, il considère la vitesse comme proportionnelle au temps. Il a même étudié le mouvement d'un corps pesant, compte tenu de la rotation de la terre, aboutissant ainsi à la considération d'une spirale d'ARCHIMÈDE. L. G.

Marcolongo, Roberto. L'edizione nazionale dei manoscritti e dei disegni di LEONARDO DA VINCI. 15 p. (Il Codice Arundel nel Museo Britannico). Roma, Nuova Antologia, 1929. ISIS

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Marcolongo, Roberto. Le ricerche geometrico-meccaniche di LEONARDO DA VINCI. VII+56 p., 4 pl. *Atti Soc. Ital. Scienze* (detta dei XL), Rome, 1929. ISIS

Reviewed by H. WIELEITNER, *Mitt. zur Geschichte der Medizin*, 29, 71, 1930

Marcolongo, Roberto. Lo strumento inventato da LEONARDO DA VINCI per la risoluzione del problema di ALHAZEN. *Rendiconti della R. Accademia d. scienze fisiche e matematiche di Napoli*, 35, 3 pl., fig., 1929. ISIS

Marcolongo, Roberto. Quelques remarques sur la publication d'un nouveau manuscrit de LÉONARD DE VINCI. *Acta mathematica*, 49, 69-94, 1926. ISIS

McCurdy, Edward. LEONARDO and the science of flight. *The nineteenth century and after*, p. 126-42, 1910. ISIS

Möller, Emil. Abbozzi e testi sconosciuti del VINCI sull anatomia. *Raccolta Vinciana*, supplemento al fascicolo XIII, 13 p., 2 fig., Milano, 1930. ISIS

Apropos of a single sheet, kept in the Weimar palace, containing anatomical drawings. G. S.

Möller, Emil. Wie sah LEONARDO aus? *Belvedere*, 29-46, ill. 1926. ISIS

Pierantoni, Amalia Clelia. Studi sul libro della pittura di LEONARDO DA VINCI. 137 p. Roma, SCOTTI, 1921. ISIS

Planiscig, L. LEONARDOS Porträte und ARISTOTELES. Festschrift für JULIUS SCHLOSSER zum 60. Geburtstage herausgegeben von ARPAD

WEIXLGÄRTNER und LEO PLANISCIG. Zürich, Amalthea Verlag, 1927. ISIS

Salomon, W. Geologische Beobachtungen des LEONARDO DA VINCI. 13 p. (*Sitzungsberichte der Heidelberger Akademie der Wissenschaften, math.-naturwiss. Klasse*, Jahrg. 1928, 8). Berlin, DE GRUYTER, 1928. ISIS

Sirén, Osvald. LÉONARD DE VINCI. L'artiste et l'homme. Édition entièrement refondue et mise à jour. Traduction française par JEAN BUHOT. 2 vols. Paris, VAN OEST, 1928. ISIS

Suida, Wilhelm. LEONARDO Bildnis. *Pantheon*, 72-74, ill., München, 1928. ISIS

Suida, Wilhelm. LEONARDO und sein Kreis. 327 p., 192 pl., 335 fig. München, BRUCKMANN, 1929. ISIS

Vetri, Paolo. Da alcune note di LEONARDO allo stereoscopio. *Atti della Accademia Pontaniana*, 31, 69-88, Napoli, 1926. ISIS

XVIth Century (whole and first half)

B. — *Physical sciences and technology*

Agricola, Georgius. De re metallica. Translated from the first Latin edition of 1556 with biographical introduction, annotations and appendices upon the development of mining methods, metallurgical processes, geology, mineralogy and mining law from the earliest times to the 16th century, by HERBERT CLARK HOOVER and LOU HENRY HOOVER. XXXI+640 p., London, published for the translators by The Mining Magazine, 1912. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 113-16, 1929.

Agricola, Georg. Zwölf Bücher vom Berg- und Hüttenwesen in denen die Ämter, Instrumente, Maschinen und alle Dinge, die zum Berg- und Hüttenwesen gehören, nicht nur aufs deutlichste beschrieben, sondern auch durch Abbildungen, die am gehörigen Orte eingefügt sind, unter Angabe der lateinischen und deutschen Bezeichnungen aufs klarste vor Augen gestellt werden. Sowie sein Buch von den Lebewesen unter Tage. In neuer deutscher Übersetzung bearbeitet von CARL SCHIFFNER unter Mitwirkung von ERNST DARMSTAEDTER, PAUL KNAUTH, WILHELM PIEPER, FRIEDRICH SCHUMACHER, VICTOR TAFEL, EMIL TREPTOW, ERICH WANDHOFF. Herausgegeben und verlegt von der Agricola-Gesellschaft beim Deutschen Museum.

XXXII+564 p. folio. illus. Berlin, Verein deutscher Ingenieure, 1928. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 113-16, 1929.

Johannsen, Otto. PEDER MÅNSSON und seine Schriften. *Beiträge zur Geschichte der Technik und Industrie*, 19, 171-72, 3 fig., Berlin, 1929. ISIS

« PEDER MÅNSSONS Schriften haben in Schweden schon früh Beachtung gefunden und werden dort als wichtige Quellen zur Geschichte der schwedischen Kultur und als Denkmäler der alten schwedischen Sprache hoch geschätzt. Wenig bekannt ist aber ausserhalb des schwedischen Reiches, dass in diesen Schriften wertvolle Angaben über die chemische-metallurgische Technik des ausgehenden Mittelalters erhalten sind. Auf Grund der Ausgabe der in schwedischer Sprache geschriebenen Schriften PEDER MÅNSSONS, die der verstorbene Oberbibliothekar der Königlichen Bibliothek in Stockholm ROBERT GEETE verfasst hat, und einer älteren Studie von G. O. HYLTÉN-CAVALLIUS sei deshalb nachstehend kurz über PEDER MÅNSSON und seine Schriften berichtet. »

C. — *Natural sciences*

Almagià, Roberto. La carta della Palestina di GERARDO MERCATORE (1537). Riprodotta per la prima volta dall' unico esemplare esistente nella Biblioteca comunale di Perugia. (*Fondo italiano per lo studio della Palestina*, Pubblicazione No. 1.) 8 p., map. Florence, Istituto Geografico Militare, 1927. ISIS

The large (110 × 55 cm.) map of Palestine here reproduced was discovered by Professor ALMAGIÀ in 1926 (see *Isis*, 10, 145, 1928). An historical map, made to serve « biblical students and antiquarians in general, » it appears to have been based altogether on a treatise on Palestine, with maps, by JACOB ZIEGLER, STRASSBURG, 1532. « It did not exert much influence on subsequent cartographic tradition. » J. K. W.

Garcia, Andres Bellogin. Vida y hazañas de ALVAR NÚÑEZ CABEZA DE VACA. (*Colección de Manuales Hispania*, vol. V, serie A.) 264 p., 2 maps. Madrid, Editorial Voluntad, 1928. ISIS

Heawood, Edward. An undescribed LAFRERI atlas and contemporary Venetian collections. *Geographical Journal*, 73, 359-69, illus., 1929. ISIS

Biobibliographical data on sixteenth century maps and cartographers. The Venetians, it appears, made the most original maps. « Original work published at Rome was for the most part of more restricted scope, concerned with local Italian topography. » J. K. W.

Kahle, Paul. PIRI RE'ÎS und seine Baḥrîje. *Beiträge zur historischen*

Geographie, Kulturgeographie, Ethnographie und Kartographie, vornehmlich des Orients, hrsg. von HANS MZIK, p. 60-76, 7 illus. Leipzig, DEUTICKE, 1929. ISIS

Since publishing in 1926 the text and a translation of PIRI RE'IS' Baḥrije, a Turkish navigation manual of the Mediterranean (1521) (*Isis*, 11, 438, 1928), KAHLE has been able to examine manuscripts of a second edition with which he was not previously familiar. He here translates and discusses certain excerpts from this edition, including two chapters on the China Sea. J. K. W.

(Magellan). A link with MAGELLAN, being a chart of the East Indies, c. 1522, in the possession of BOIES PENROSE. 21 p., map. Privately printed, 1929. ISIS

A magnificent reproduction of a 16th century Spanish chart of the East Indies with explanatory text. The anonymous writer of the text believes the map may well have been the « work of one of the survivors of MAGELLAN's ill-fated... expedition. » J. K. W.

Savi-Lopez, Maria. BERNAL DIAZ DEL CASTILLO e « La vera storia della conquista della Nuova Spagna. » *Atti del XXII Congresso Internazionale degli Americanisti*, Roma, Settembre 1926, 2, 743-57, Rome, 1928. ISIS

Steffen, Hans. Los fundamentos histórico-geográficos de la leyenda de « Los Cesares ». *Gaea : Anales de la Sociedad Argentina de Estudios Geográficos*, 3, 16-35, map, 1928. ISIS

The journey of FRANCISCO CÉSAR, « one of the lieutenants under SEBASTIAN CABOT on his expedition to the Rio de la Plata in 1528 », gave rise to the so-called « legend of the Césares. » This was to the effect that a territory of great riches in gold and precious metals existed in the Andean region to the west of the Patagonian pampa. Toward the end of the century it came to be believed in Chile and along the Plata that there was a city of the Césares inhabited by white men, the survivors of a shipwreck in the Strait of Magellan. The legend persisted under one form or another until as late as the beginning of the nineteenth century. J. K. W.

Taylor, E. G. R. French cosmographers and navigators in England and Scotland, 1542-1547. *The Scottish Geographical Magazine*, 46, 15-20, ill., 1930. ISIS

Taylor, E. G. R. ROGER BARLOW : A new chapter in early Tudor geography. *Geographical Journal*, 74, 157-66, 3 figs., 1929. ISIS

ROGER BARLOW accompanied SEBASTIAN CABOT's expedition to La Plata in 1526. His unpublished Geography, 1540-41 (British Museum : Royal MSS. 18 B. XXVIII) is in the main « a literal translation of the Suma de Geographia of MARTIN FERNANDES DE ENCISO » (Seville, 1529) to which

has been added » a long account of the Parana-Plate region », an account of MAGELLAN's voyage, « personal notes on the Canaries, Azores and Morocco,» etc. Miss TAYLOR recommends that the account of Brazil be printed in extenso, as it was the first to be written in English. J. K. W.

Wagner, Henry R. Spansih voyages to the northwest coast of America in the sixteenth century. VIII+571 p., 20 maps. (*California Historical Society*, Special publication no. 4). San Francisco, 1929. ISIS

In this substantial volume WAGNER presents the results of many years of study of the Spanish voyages along the California coast and northward in the sixteenth and early seventeenth centuries. The historical circumstances leading up to and resulting drom the explorations of ULLOA (1539-40), BOLAÑOS (1541), CABRILLO (1542), URDANETA (1565), UNAMUNO (1586-87), CERMEÑO (1595), VIZCAINO, and others, are fully set forth and the pertinent texts given in English translations (some of them by Miss I. A. WRIGHT). Points of detail, particularly relating to the identification of places, are discussed in notes at the end of the volume. In the appendix line-cut reproductions are given of certain of the more important manuscript sources. There are also many excellent reproductions of early maps illustrating the progress of cartographic knowledge of western North America. The volume is a fundamental contribution to the history of exploration. J. K. W.

Wright, I. A. Spanish documents concerning English voyages to the Caribbean 1527-1568. Selected from the archives of the Indies at Seville by I. A. WRIGHT. X+167 +XLVI p., 2 maps, ills. London, Hakluyt Society, 1929. ISIS

Reviewed by C. H. HARING, *American Historical Review*, 35, 626-27, 1930.

D. — *Medical sciences*

Bologa, Valeriu L. PARACELSUS in der siebenbürgisch-sächsischen Volkssage. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 96-98, 1930. ISIS

Brunn, Walter v. PARACELSUS und Wundheilung. GEORG STICKER Festgabe, 73-81, Berlin, SPRINGER, 1930. ISIS

Crummer, Le Roy. An original drawing of the title page of VESALIUS' Fabrica. *Annals of Medical History*, 11, 20-30, 6 fig., 1930. ISIS

Darmstaedter, Ernst. PARACELSUS und die Einführung chemischer Präparate als Heilmittel. GEORG STICKER Festgabe, 63-72, Berlin, SPRINGER, 1930. ISIS

(Paracelsus). *Acta paracelsica*. Im Auftrag der Paracelsus-Gesell-

schaft herausgegeben von ERNST DARMSTAEDTER, RICHARD KOCH, MANFRED SCHROETER. Heft 1. 48 p., 2 pl., München, 1930. ISIS

On the Paracelsus Gesellschaft, see *Isis*, 13, 361-62. The first number of its *Acta* contains the following papers : K. SUDHOFF : Geleitwort; FRANZ STRUNZ : PARACELSUS zwischen den Zeiten, I; RICHARD KOCH : PARACELSUS in der Dauer der Zeit, I.; ERNST DARMSTAEDTER : Paracelsus, Arznei und Alchemie; RAYMUND NETZHAMMER. Ein neu aufgefundener Namenszug HOHENHEIMS; K. SUDHOFF : Nachweise zur PARACELSUS-Literatur, I. G. S.

Schadelbauer, Karl. Zur Erkenntnis der Infektiosität der Syphilis. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 207-08, 1930. ISIS

E. — *Alia*

Hahne, Hans. Die Wittenberger Horoskope. *Leopoldina*, vol. 5, 102-09, 1929. ISIS

Apropos of the horoscopes relative to the foundation of the university of Wittenberg, 1502, 1536. G. S.

More, Thomas. The fame of blessed THOMAS MORE. Being addresses delivered in his honour in Chelsea, July, 1929, by Father RONALD KNOX, HILAIRE BELLOC, G. K. CHESTERTON, Lord Justice RUSSELL, HENRY BROWNE, S. J., REGINALD BLUNT, and BEDE JARRETT. With an introductory essay by R. W. CHAMBERS. 152 p. London, SHEED and WARD, 1930. ISIS

XVIth Century (second half)

C. — *Natural sciences*

Césalpin.—*Questions péripatéticiennes.* Traduction de MAURICE DOROLLE (*Textes et traductions pour servir à l'histoire de la pensée moderne*, coll. dirigée par ABEL REY). VIII+242 p., Paris, ALCAN, 1929 (20 fr.). ISIS

Traduction, d'après l'édition de 1593, des fragments les plus caractéristiques des *Questionum peripateticarum libri quinque* (1571), fragments qu'une introduction de 92 p., où est examinée l'œuvre de CÉSALPIN, lie en somme les uns aux autres. Ces fragments sont surtout empruntés au livre II (théorie du premier moteur et de l'âme) et au livre V (théorie centrale de la biologie de CÉSALPIN). Il y est ajouté d'ailleurs un court fragment des *Questionum medicarum libri II* qui accompagnent les *Questiones peripateticae* dans l'édition de 1593. CÉSALPIN « se place sous le patronage d'ARISTOTE, dont il prétend restituer la pure doctrine », mais il ne saurait être tenu pour un simple commentateur; « se refusant à suivre les interprétations traditionnelles, il présente un ARISTOTE sans doute plus vrai que celui du Moyen âge, mais aussi parfois singulièrement incliné vers l'esprit moderne »; et dans plus

d'un détail, ses « explications physiques ne sont pas très éloignées de celles du XVII^e siècle ». L. G.

Couto, Gustavo. O cosmografo FERNAM VAZ DOURADO fronteiro da India e a sua obra. *Boletim da Sociedade de Geografia de Lisboa*, 46, 175-90, 1928. ISIS

FERNAM VAZ DOURADO, Portuguese fronteiro (or governor of a frontier outpost) of India, was compiler of an atlas of the world dated Gôa, 1571. J. K. W.

Lanzoni, Francesco. Una cattedra e un orto dei semplici a Parma nel 1600. *Archeion*, 11, 336-47, 1929. ISIS

Jardin botanique et enseignement y correspondant fondés à Parme aux environs de 1600 par POMPILIO TAGLIAFERRI (1554?-?) botaniste, anatomiste et accoucheur. L. G.

Parks, George Bruner. RICHARD HAKLUYT and the English Voyages edited with an introduction by JAMES A. WILLIAMSON, D. Lit., *American Geographical Society*, special publication no. 10. New York, 1928, XVII+289 p.; 32 figs. (five dollars). ISIS

Reviewed by J. K. WRIGHT, *Isis*, 13, 116-18, 1929.

Renaud, H. P. J. Un essai de classification botanique dans l'œuvre d'un médecin marocain du XVI^e siècle. Mémorial HENRI BASSET, nouvelles études nord-africaines et orientales, publiées par l'Institut des Hautes-études marocaines, p. 197-206, Paris, GEUTHNER, 1928. ISIS

Apropos of the Ḥadīqat al-azhār fī sharḥ māhīyat al-'ushb wal-'aqqār (Garden of flowers, or explanation of the characters of herbs and drugs) composed in 1586 by QÂSIM IBN MUḤAMMAD AL-WAZÎR AL-GHASSÂNÎ, physician to the Sa'dian sultan AḤMAD AL-MANṢÛR. It contains 379 articles on simples and drugs, each of which is methodically described; there are many interesting observations and a remarkable attempt to classify the plants. This is unique in Arabic literature. The Moroccan botanist may have been possibly influenced by CESALPINO's *De plantis* (1583), though this is doubtful. Dr. RENAUD concludes : « Cette réserve faite, nous n'en considérons pas moins AL-GASSÂNÎ comme un esprit exceptionnel pour l'époque et le milieu dans lesquels il a vécu. C'est par comparaison avec les nombreux traités de matière médicale des auteurs arabes qu'il faut juger son œuvre. Certes, on ne trouve pas encore chez lui la compréhension bien nette de l'importance prépondérante de la fleur, et surtout des organes de la reproduction qu'elle renferme, pour donner une base certaine à la systématique. Il confond sous le nom de ḥuyuṭ (fils), pistil et étamines, et la distinction du sexe des plantes demeure arbitraire, comme chez les Anciens. Mais il dégage déjà clairement, d'une part, l'idée de hiérarchie des caractères des végétaux, et, d'autre part, la notion de parenté entre les genres botaniques,

qu'il groupe sous une même dénomination, au moyen de ces curieux pluriels qu'il a forgés. La Ḥadîqat al-azhâr mérite d'être publiée. »

Renaud, H. P. J. La première mention de la noix de kola dans la matière médicale des Arabes. *Hespéris*, p. 43-57, 1 fig., année 1928.

ISIS

The first Arabic mention of cola is found in the Ḥadîqat al-azhâr of AL-WAZÎR AL-GHASSÂNÎ (1586) to which the author has already devoted two other studies. The relevant text is translated. I may recall that the earliest European description of the one kind of cola *(Sterculia acuminata)* was given by the Portuguese EDUARDO LOPEZ as quoted by PIGAFETTA in 1589; the earliest description of the other kind *(Sterculia nitida)* was given by CLUSIUS, 1605. An earlier description by LEO THE AFRICAN lacks precision, but he calls the plant goro, a name which is used in this and other forms in many western African languages. G. S.

Revelli, Paolo. L'area dell'America spagnuola secondo un geografo italiano del cinquecento. *Atti del XXII Congresso Internazionale degli Americanisti*, Roma, Settembre 1926, 2, 727-38, Rome, 1928.

ISIS

A treatise entitled *Discorso... della grandezza de' Stati, Domini de cinque frà li piu Potenti Regi e Signori dell'Universo* was first published in 1590 as an appendix to an Italian translation of a work by RENÉ DE LUCINGE, *Dell'origine, conservatione et decadenza degli Stati*, where it is ascribed to ORAZIO MALAGUZZI VALERI. A note on a MS. of this treatise in the Ambrosian Library at Milan indicates that it was actually written by the « mathematician, physician, astronomer, physicist, and geographer » GIUSEPPE MOLETO (1531-1588). The following areas in Italian square miles were assigned by MOLETO to the five greatest empires : Dominion of the Catholic King (including, at that time, the Portuguese possessions) : 8.000.000; Dominion of Prester John (Ethiopia) : 5.500.000; Dominion of the Grand Khan of Tartary : 2.200.000; Dominion of the King of Persia : a little over 2.000.000; Dominion of the Turk : a little less than 1.400.000. The area of the Spanish dominions is apparently underestimated. It is difficult, however, to compare MOLETO's areas with modern areas because we know nothing of his methods of calculation and because he took into consideration settled areas only. The treatise is of interest, however, as embodying the results of « the first areal measurements of large political units. » J. K. W.

Rocart, Eug. Les cartographes du XVI^e^ siècle : I. JEAN DE SURHON, *Bulletin de la Société Royale Belge de Géographie* 52, 122-29, 1928.

ISIS

Biographical notes on an obscure but gifted Belgian cartographer. His map of the county of Namur (1555), of Picardy, and Vermandois « nous révèlent un travail consciencieux et fouillé, une exactitude et une précision quasi mathématique, une clarté du détail, une netteté des lignes, bref une connaissance du métier pour le moins égale à celle de ses compatriotes du Nord tels que DEVENTER et SGROOTEN. » J. K. W.

D. — *Medical sciences*

Camden, Carroll, jr. Elizabethan astrological medicine. *Annals of medical history*, 11, 217-26, 1930. ISIS

Deuchler, W. JUAN DE CÁRDENAS. Ein Beitrag zur Geschichte der spanischen Naturbetrachtung und Medizin in Mexiko während des 16. Jahrhunderts. Geleitwort von HENRY E. SIGERIST. IV+121 p. Bern, PAUL HAUPT, 1930 (Mk. 4). ISIS

PRIMERA PARTE
DE LOS PROBLEMAS,
y ſecretos marauillоſos de las
Indias. Compueſta por el Do-
ctor Iuan de Cardenas
Medico.
Dirigida al Illuſtriſsimo Señor Don Luys
de Velaſco, Virrey dſta nueua Eſpaña.

Con Licencia. En Mexico, En caſa de
Pedro Ocharte. Año d 1591.

This study is essentially based upon the curious book published by JUAN DE CÁRDENAS in Mexico 1591 (see fig.) and reprinted in Mexico 1913 (the author used only that reprint). JUAN DE CÁRDENAS was born in Constantina, near Seville; he emigrated to New Spain very early and studied in Mexico; in 1581 he became bachiller en artes in that city, and three years later bachiller en medicina; he practised medicine in Guadalajara until 1588 when he returned to Mexico city; he attained his doctorate in 1590 and became professor of medicine in 1595; he died in 1609. He published a little work on chocolate *Del chocolate qué provecho hace y si es bebida saludable ò no* (Mexico, 1606), but is chiefly remembered for his *Problemas y secretos marauillosos de las Indias* above mentioned. DEUCHLER gives an analysis of it. It is a very interesting work, which helps us to realize the gigantic intellectual conflict which troubled the minds of the sixteenth century Aristotelians when they had suddenly to face all the new circumstances and problems of the New World. This conflict became more acute after the intense activity of the

siglo de oro (1492-1588) when people become more reminiscent. What a subject of meditation for the tragic souls of Spain, and for those perhaps even more tragic which had tasted the novelties and deceptions of New Spain ! The author has added two chapters dealing respectively with Spanish medicine in the sixteenth century and with the early literature of Mexico.
G. S.

Robert, Armand. AMBROISE PARÉ, médecin-légiste. 180 p. (*Thèse* de la Faculté de médecine de Paris). Paris, 1929. ISIS

Reviewed by PAUL DELAUNAY, *Bulletin de la Société française d'histoire de la médecine*, 24, 49, 1930.

E. — *Alia*

Baron, Salo. La méthode historique d'AZARIA DE ROSSI. 62 p. Paris, 1929. Extrait de la *Revue des études juives*, vols. 86-87. A. M.
ISIS

Doty, Joseph D. Sir THOMAS BODLEY and his library. *Faculty papers of Union College*, 1, 122-42, Schenectady, N. Y., 1930. ISIS

Orbaan, J. A. F. Records of Roman town planning. *Town Planning Review*, 13, 257-60, 2 pl., 1929. ISIS

Reproduction and discussion of a map of Rome, 1590, revealing a concept of town-planning technique far in advance of that which prevailed elsewhere in the Europe of the period.
J. K. W.

XVIIth Century (whole and first half)

B. — *Physical sciences and technology*

Crommelin, C. A. Het lenzen slijpen in de 17e eeuw. IV+45 p., 29 ill. Amsterdam, H. J. PARIS, 1929. ISIS

Jolie plaquette fort agréablement illustrée de portraits et de figures tirées de travaux du XVIIe S., consacrée par l'auteur aux principaux tailleurs et polisseurs de lentilles : DESCARTES, CHRISTIAN HUYGENS et son frère CONSTANTIN le jeune, JOHANNES HEVELIUS, JOHN REEVES, GIUSEPPE CAMPANI, EUSTACHIO DIVINI, ROBERT HOOKE, CHRISTOPHER WREN, E. W. VON TSCHIRNHAUSEN, NICHOLAUS HARTSOEKER, SPINOZA, ARNOLD MARCEL, F. E. MAIGNAN, ANTONY VAN LEEUWENHOEK, JOHN HUDE, SAMUEL et JEAN VAN MUSSCHENBROEK, NEWTON ; les dessins de machines à tailler de CHR. HUYGENS, HOOKE, HEVELIUS, MAIGNAN, sont tirés de l'*Oculus artificialis* de JOHANNES ZAHN, 1685 et 1702.
L. G.

Kepler, Johannes. Neue Astronomie. Übersetzt und eingeleitet von MAX CASPAR. 416 p., XIII+68 fig. München, R. OLDENBOURG, 1929 (Gebunden, Mark 38.50). ISIS

Reviewed by G. SARTON, *Isis*, 13, 118, 1929.

Schefold, M. KEPLER und das Ulmer Mass- und Gewichtssystem. *Beiträge zur Geschichte der Technik und Industrie*, 19, 167-70, 1 fig., Berlin, 1929. ISIS

Schimank, Hans. OTTO VON GUERICKE. Leben und Werk eines deutschen Ingenieurs. *Beiträge zur Geschichte der Technik und Industrie*, 19, 12-30, 8 fig., Berlin, 1929. ISIS

C. — *Natural sciences*

Andreae, Sybrandus Johannes Fockema. Naar aanleiding van FLORIS BALTHASARS groote kaart van Rijnland. Uitgegeven in 1615. Opnieuw uitgegeven in 1929. *Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap*, 2. reeks, 46, 372-79, 1929. ISIS

Notes on a map of which a new edition has recently been published by MARTINUS NIJHOFF, The Hague. J. K. W.

Anthiaume, A. Le dieppois GUILLAUME LE VASSEUR, sieur de Beauplan, ingénieur du roi au XVII^e siècle. *Comité des Travaux Historiques et Scientifiques : Bulletin de la Section de Géographie*, 43, 209-19, 1928. ISIS

LE VASSEUR (born latter 16th c.; d. 1685?) is notable for maps of Poland and Normandy made under his direction and as the author of a volume on Poland and of several treatises of use to navigators. J. K. W.

Brackenhoffer, Elie. Voyage en France. T. 1 : 1643-1644. T. 2 : 1644-1646. Traduit d'après le manuscrit du Musée historique de Strasbourg, par HENRY LEHR. 2 vol., maps. Nancy, BERGER-LEVRAULT, 1925-1927. ISIS

Reviewed by JEAN CORDEY, *Bibliothèque de l'École des Chartes*, 89, 392-93, 1928.

D. — *Medical sciences*

Heitz, Jean. Simulation d'une crise de possession dans le Volpone de BEN JONSON (1605). *Bulletin de la Société française d'histoire de la médecine*, 23, 346-49, 1929. ISIS

Neuburger, Max. Zur Entdeckungsgeschichte des Lungenkreislaufes. *Archiv für Geschichte der Medizin*, 23, 7-9, 1930. ISIS

Pfeilsticker, Walther. JOHANNES RÜMELIN (1583-1632). *Archiv für Geschichte der Medizin*, 22, 174-88, Abb., 1929. ISIS

Rolleston, Sir Humphry. Sir THOMAS BROWNE, M. D. *Annals of Medical History*, 11, 1-12, 1930. ISIS

Sudhoff, Karl. WILLIAM HARVEY. Eine Zentenarbetrachtung. 7 p. Sonderdruck aus der *Münchener Medizinischen Wochenschrift*, Nr. 15, S. 658, 1928. ISIS

E. — *Alia*

Cantecor, G. Études cartésiennes. L'oisive adolescence de DESCARTES. *Revue d'histoire de la philosophie*, 4, 1-38, 1930. ISIS

De Lint, J. G. REMBRANDT. (Great painters and their works as seen by a doctor. A series of monographs edited by J. G. DE LINT, vol. 1). 113 p., 64 ills. The Hague, KRUSEMAN, 1930 (*f* 2.50). ISIS

To quote the author's own words : « The purpose of the series of monographs, of which this is the first, is to analyse works of the Dutch painters of the 17th and 18th centuries and to notice what they contain of medical interest. Beginning with REMBRANDT, we have for this purpose gone through all his works, revising his paintings, etchings and drawings and noting down everything of interest to those that are connected with Medicine. » The choice of REMBRANDT for the first monograph is very fortunate, for he is one of the painters whose appeal is truly international. The subject is divided as follows : Introduction. 1. Physicians and quacks; 2. Portraits of physicians; 3. Anatomy; 4. Internal medicine; 5. Miraculous healings; 6. Surgery; 7. Ophtalmology; 8. Lying-in room and care of infants; 9. Conclusion. The volume is very handsomely printed and admirably illustrated. If it has no other result but to turn the minds and hearts of physicians toward REMBRANDT and to teach them a better appreciation of art, its publication will be amply justified. G. S.

XVIIth Century (second half)

A. — *Mathematics*

Carruccio, Ettore. Il « Nuovo Metodo » di LEIBNIZ, con note storiche. 5 figs. *Periodico di matematiche*, 7, 285-301, 1927. ISIS

(Newton, Isaac). *Die Fortschritte der Physikalischen Wissenschaften.* Heft 2, Bd. 7, 73-163, 1927. ISAAK NEWTON gewidmet. (Russ.) ISIS

Die führende Zeitschrift widmet ein spezielles Heft (90 Seiten) der Erinnerung an ISAAK NEWTON. Es enthält Aufsätze von : W. K. FREDERIX « NEWTONS Mechanik und das Relativitätsprinzip » (75-86). S. WAWILOW « Die Prinzipien und die Hypothese der NEWTON'schen Optik » (87-106). I. FRENKEL « Mechanische und elektromagnetische Eigenschaften der Licht-

atome (Quanten) » (106-120). Den Schluss bildet eine sorgfältige Uebersetzung der « Optischen Memoiren » von NEWTON, die WAWILOW mit einer Reihe historischer Bemerkungen versorgt hat (S. 121-63). M. B.

Wieleitner, Heinrich. Die Verdienste von JOHN WALLIS um die analytische Geometrie. *Das Weltall*, 29, 56-80, 2 fig., 1930. ISIS

« WALLIS hat tatsächlich als erster wesentliche Eigenschaften der Kegelschnitte rein analytisch aus deren Gleichungen abgeleitet (1655). Und er ist lange der einzige geblieben. Wir finden erst wieder Aehnliches, aber nur in Ansätzen, bei JAKOB STIRLING in seiner Schrift ' Lineae tertii ordinis Neutonianae ' (Oxoniae 1717), was ich schon früher näher ausgeführt habe. Eine vollständige analytische Geometrie der Kegelschnitte, ohne die Stütze, ' bekannter ' geometrischer Sätze gab erst L. EULER in seiner ' Introductio in analysin infinitorum ' (Lausannae 1748). Zwischenstufen gibt es nicht. Um so höher darf man WALLIS' Leistung bewerten. »

B. — *Physical sciences and technology*

Forti, Umberto. La teoria della gravitazione di HUYGHENS. *Periodico di matematiche*, 6, 305-13, 1926. ISIS

Forti, Umberto. Splendore e decadenza della teoria ondulatoria della luce nel secolo diciassettesimo. 7 figs. *Periodico di matematiche*, 8, 317-33, 1928. ISIS

Huygens, Christian. *Œuvres complètes*, publiées par la Société Hollandaise des sciences. T. XVI, 600 p., fig., 1 pl. La Haye, M. NIJHOFF, 1929. ISIS

Ce XVI[e] vol. des Œuvres complètes de CHRISTIAN HUYGENS, qui ne le cède en rien aux précédents quant à la présentation, comprend : 1° le traité *de Motu corporum ex percussione* (opuscula postuma, 1703) (En appendice sont publiés un premier Ms. de 1652 annoté par l'auteur en 1654, et une partie d'un second Ms. de 1656, qui renferme déjà le contenu essentiel du traité définitif, et différentes notes de HUYGENS échelonnées entre 1656 et 1667); 2° Extrait d'une lettre de M. HUYGENS à l'auteur du Journal sur les règles du mouvement dans la rencontre des corps, 1669, où HUYGENS publie les lois du choc (Le journal en question est *Philosophical transactions*); 3° divers Ms. ultérieurs concernant l'historique de la théorie du choc des corps et la question de l'existence et de la perceptibilité du « mouvement absolu »; 4° *De vi centrifuga*, écrit en 1659, et publié également huit ans après la mort de l'auteur, en 1703, par les soins de VOLDER et FULLENIUS, à qui HUYGENS, par testament, avait légué la tâche de publier ses œuvres non encore éditées; au traité sont ajoutés quelques appendices de dates diverses; 5° Travaux divers de statistique (3) et de dynamique (19), de 1659 à 1666, inédits pour la plupart. Comme il est coutume dans chacun des volumes du monument remarquable élevé à la mémoire de HUYGENS par la Société hollandaise des sciences (*Isis*, 5, 154-6), chacun des travaux publiés

est précédé d'un avertissement où l'œuvre est mise en place et commentée comme il se doit. L. G.

Wren, Sir Christopher. The sixth volume of the Wren Society, 1929. The Royal Hospital for seamen at Greenwich, 1674-1728. Original drawings by Sir CHRISTOPHER WREN, Sir JOHN VANBRUGH, NICHOLAS HAWKSMOOR, JOHN JAMES. From the collections at the Bodleian, All Souls College, Worcester College, Sir John Soane's Museum, Royal Naval Museum, Greenwich, R. I. B. A. Library. 82 p., LIII pl. For the Wren Society, Oxford University Press, 1930. ISIS

C. — *Natural sciences*

Dampier, William. A new voyage round the world. With an introduction by Sir ALBERT GRAY. XXXVII+376 p., maps, illus., index. London, Argonaut Press, 1927. ISIS

A reprint of the seventh edition of DAMPIER's Voyage (1729), with a bibliographical preface by the editor, Mr. N. M. PENZER. DAMPIER's whole time on his voyage « so far as it was not interrupted by raids or the quarrels of his rowdy associates, was devoted to close observation of winds and tides, geography, plants, and animal life. ». J. K. W.

Fanelli, P. Antonio Maria. Relación de un viaje a Chile en 1698 desde Cadiz, por mar y por tierra, escrita en italiano por el P. ANTONIO MARIA FANELLI, de la Compañía de Jesus. Version castellana de ELVIRA ZOLEZZI, precedida de una noticia bio-bibliográfica por J. T. MEDINA. *Revista Chilena de Historia y Geografia*, T. 61, no. 65, 96-194, 1929. ISIS

D. — *Medical sciences*

Ebstein, Erich. JOH. DANIEL MAJORS Spritze zur intravenösen Injektion. GEORG STICKER, zu seinem 70. Geburtstag am 18. April 1930, p. 9-11, München, 1930. ISIS

« Die erste intravenöse Injektion hat MAJOR am 21. März 1668 ausgeführt. Die Methode wurde dann auch von anderen Aerzten angewandt, wie ich früher näher ausgeführt habe. (EBSTEIN, *Medical Life*, Dezember 1923, S. 601-611.) Später geriet diese Methode in Vergessenheit, bis sie am 27. Mai 1881 von A. S. LANDERER in Leipzig wieder neu entdeckt wurde. MAJOR war ein vielseitiger Gelehrter, geboren am 18. August 1634 in Breslau. Später war er Professor in Kiel und starb am 3. August 1693 in Stockholm. »

Goulard, Roger. Quelques maîtres-chirurgiens Briards. ANTOINE GILLES, le jeune (1661-1713). *Bulletin de la Société française d'histoire de la médecine*, 24, 6-16, 1930. ISIS

Haustein, Hans. Die Bekämpfung der Prostituierten und der Geschlechtskrankheiten in Berlin um 1700. GEORG STICKER Festgabe, 82-88, Berlin, SPRINGER, 1930. ISIS

Hühnerfeld, J. Die Stellung SPINOZAS und HOBBES zur Medizin, insbesondere zur Physiologie ihrer Zeit. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 113-34, 1930. ISIS

E. — *Alia*

Gunther, Robert Theodore. Early science in Oxford. Vol. IV. The Philosophical Society. VIII+259 p., 4 illus. Oxford, Printed for the subscribers, 1925.

Reviewed by G. SARTON, *Isis*, 13, 118-19, 1929.

XVIIIth Century (whole and first half).

A. — *Mathematics.*

Spiess, Otto. LEONHARD EULER. Ein Beitrag zur Geistesgeschichte des XVIII. Jahrhunderts. 288 p. (*Die Schweiz im deutschen Geistesleben.* Hrsg. v. HARRY MAYNC. Bd. 63 u. 64.) Frauenfeld, HUBER, 1929. ISIS

Reviewed by ADOLF KNESER, *Deutsche Literaturzeitung*, 1, 236-38, 1930; by H. WIELEITNER, *Mitt. zur Geschichte der Medizin*, 29, 72, 1930.

Thiersch, Hermann. Zur Ikonographie LEONHARD und JOHANN ALBRECHT EULERS. 26 p., 6 pl., fig. *Nachr. Ges. Wiss. Göttingen* (Phil.-hist. Kl.), 1929. ISIS

B. — *Physical sciences and technology*

Dickinson, H. W. THOMAS NEWCOMEN und seine Dampfmaschine. Ein Rückblick auf die Zeit vor 200 Jahren. *Beiträge zur Geschichte der Technik und Industrie*, 19, 139-43, Berlin, 1929. ISIS

Kurzel-Runtscheiner, Erich. Die Fischer von Erlach'schen Feuermaschinen. Ein Beitrag zur Geschichte der Ingenieurkunst nach Mitteilungen verschollener Bücher und nach bisher unbekannten Archivalien. *Beiträge zur Geschichte der Technik und Industrie*, 19, 71-91, 16 fig., Berlin, 1929. ISIS

Masotti, Arnaldo. Appunti storici sul paradosso di d'ALEMBERT. 1 fig. *Periodico di matematiche*, 8, 239-56, 1928. ISIS

Metzger, Hélène. La théorie du feu d'après BOERHAAVE. *Revue philosophique*, 109, 253-85, 1930. ISIS

C. — *Natural sciences*

Birket-Smith, Kaj. VITUS BERING og hans rejser. *Geografisk Tidsskrift*, 31, 131-38, 1928. ISIS

Clark-Kennedy, A. E. STEPHEN HALES, D. D., F. R. S. An eighteenth century biography. XII+256 p., 14 pl. Cambridge, University Press, 1929. New York, MACMILLAN, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 370-73, 1930.

Filippi, Filippo de. Il « Ragguaglio » e le « Memorie de' viaggi e missione nel Tibet » di padre IPPOLITO DESIDERI da Pistoia. *Bollettino della R. Società Geografica Italiana*, serie VI, vol. VI, p. 295-301, 1929. ISIS

English writers on Tibet have overlooked the travels of DESIDERI in 1715-1721 and have been unaware of the fact that the MS. of DESIDERI's Relazione gives the first detailed and accurate description of that region. DE FILIPPI in this article announces that he is preparing a critical English edition of DESIDERI's work. J. K. W.

Fussell, G. E. Agriculture and economic geography in the eighteenth century. *Geographical Journal*, 74, 170-78, bibliog. 1929. ISIS

Points out the value as well as the shortcomings of fourteen general descriptions of England that appeared between 1659 and 1788, as sources for the study of the economic geography and particularly of the agriculture of the period. J. K. W.

Walter, Richard. ANSON's voyage round the world. A new edition edited with prefatory notes by G. S. LAIRD CLOWES. LXIV+402 p., maps, illus. London, HOPKINSON, 1928. ISIS

Commodore GEORGE ANSON's voyage (1740-44) was an episode in the War of the Austrian succession, the purpose being an attack on « the Spanish port and shipping on the west coast of America. » J. K. W.

D. — *Medical sciences*

Goulard, R. Documents. *Bulletin de la Société française d'histoire de la médecine*, 23, 364-66, 1929. ISIS

« Acte de cession du privilège de maître-chirurgien de PIERRE QUINARD en faveur de JEAN DÉROULLÈDE-FAVARD et lettres de maîtrise de barbier chirurgien accordées à ce dernier. »

Kleij, J. J. van der. Pokken in vroeger tijd : de inenting. *Bijdragen tot de geschiedenis der geneeskunde*, 10, 73-80, 1930. ISIS

Schöppler, Hermann. Dr. med. JOSEPH ANTON KAPPELLER, ein churfürstlich bayerischer Feld- und Stabsmedikus 1708-1749. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 208-12, 1 fig., 1930. ISIS

Schuster, Julius. Die Heilmittellehre LINNÉS. GEORG STICKER Festgabe, 89-99, 1 fig., Berlin, SPRINGER, 1930. ISIS

E. — *Alia*

Duschinsky, C. Rabbi DAVID OPPENHEIMER (1664-1736). Glimpses of his life and activity, derived from his manuscripts in the Bodleian Library. *Jewish Quarterly Review*, 20, 217-47, 1930. ISIS

Göttingen. Göttingens kulturelle Bedeutung im 18. Jahrhundert. Katalog der anlässlich der 56. Versammlung deutscher Philologen und Schulmänner vom 27. bis 30. Sept. 1927 im historischen Saal der Göttinger Universitäts-Bibliothek veranstalteten Ausstellung. VI+58 p., 1 fig. Göttingen, DIETERICH'sche Universitäts-Buchdruckerei, 1927. ISIS

Schneider, Herbert and **Carol.** SAMUEL JOHNSON. His career and writings. With a foreword by NICOLAS MURRAY BUTLER. In four volumes. Vol. 1., Autobiography and letters XVII+526 p. Vol. 2., The philosopher. VIII+603 p. Vol. 3., The churchman, IX+641 p. Vol. 4. Founding King's College. VIII+397 p. New York, Columbia University Press, 1930. ISIS

Stein, Robert. Naturwissenschaftliches bei LESSING und HERDER. GEORG STICKER Festgabe. 112-17, Berlin, SPRINGER, 1930. ISIS

XVIIIth Century (second half)

B. — *Physical sciences and technology*

Bloch, M. 150 Jahre der Entdeckung des Sauerstoffes. *Priroda*, 12, p. 107 (Russ.). ISIS

Kurze historische Schilderung des Beginns der quantitativen Chemie nebst Untersuchung, wer als der Entdecker des Sauerstoffes zu betrachten ist. M. B.

Kablukow, I. A. LAVOISIERS Verbrennungstheorien. *Techniko-Ekonomitschesky Westnik*. 6, 496-501, 1926 (Russ.). ISIS

Im Jahre 1936 sind 150 Jahre verflossen seit LAVOISIER seine Verbrennungstheorie aussprach. Prof. I. A. KABLUKOW widmet diesem historischen Moment einen interessanten Rück- und Ausblick. M. B.

Reilly, J.; O'Flynn, N. RICHARD KIRWAN, an Irish chemist of the eighteenth century. *Isis*, 13, 298-319, pl., 1930. ISIS

Biography of RICHARD KIRWAN (1733-1812), one of the most distinguished chemists of his time. His Essay on the phlogiston (1787) was translated into French by LAVOISIER and others, the French version of each section being followed by a refutation. KIRWAN was great enough to recognize his defeat in 1791. Bibliography of his abundant writings and portrait. G. S.

C. — *Natural sciences*

Badey, Lucien. BUFFON, précurseur de la science démographique. *Annales de Géographie*, 38, 206-220, 1929. ISIS

On the basis of the data in parish registers and similar documents GEORGE LOUIS LECLERC, Comte de BUFFON (1707-1788) carried out certain statistical researches that were both accurate and original. The results are presented in vol. 7 of his Supplément à l'Histoire naturelle. He was particularly interested in the question of mortality at different ages, and in the geographical problem of the relations between soil, wealth, and birth and death rates. He investigated the demography of Paris, of provincial towns, and of rural communities in France and compared his figures with contemporary statistics for London and rural England. In estimating the total population of France his method, judged by modern scientific standards, was less fortunate than that employed in his more detailed studies. It is striking that no conception of density of population existed in BUFFON's time. J. K. W.

Caraci, Giuseppe. Il generale francese GIORGIO ENRICO VITTORIO COLLOT ed il suo viaggio nell'America settentrionale (1796). *Atti del XXII Congresso Internazionale degli Americanisti*, Roma, Settembre, 1926. 2, 619-48, Rome, 1928. ISIS

The original narratives of the voyage of COLLOT (1751-1780?) in the Mississippi valley, were published in Paris in French and English in 1826. J. K. W.

Douglas, H. P. COOK as an hydrographical surveyor. *Geographical Journal*, 73, 110-16, 1929. ISIS

Dyson, Sir Frank. Captain COOK as an astronomer. *Geographical Journal*, 73, 117-19, 1929. ISIS

Franchini, Giuseppe. LAZZARO SPALLANZANI (1729-1799). *Annals of Medical History*, 11, 56-62, 2 fig., 1930. ISIS

Franchini, Giuseppe. SPALLANZANI. *Revue générale des sciences*, 40, 695-706, 4 fig., 1929. ISIS

Jacobsen, Victor C. JOHN COAKLEY LETTSOM and relations with JONATHAN CARVER, explorer of the Middle West. *Annals of Medical History*, 11, 216, 3 figs., 1930. ISIS

Johnson, R. Brimley. The flora of Mrs. DELANY. *The Connoisseur*, 78, 220-27, 9 figs. London, 1927. ISIS

Apropos of the most interesting flower pictures in cut paper work which MARY GRANVILLE DELANY (1700-88) began at the age of 74 and ended in her 86th year. They are kept in the British Museum, and a few of them in Windsor Castle. G. S.

Newbolt, Sir Henry. Captain JAMES COOK and the Sandwich Islands *Geographical Journal*, 73, 97-101, 3 illus., 1929. ISIS

Rose, J. Holland. Captain COOK and the founding of British power in the Pacific. *Geographical Journal*, 73, 102-09, illus., 1929. ISIS

The Secret Instructions of the British Admiralty recently published by the Naval Records Society (*Naval Miscellanies*, 3, 1928, 343-50, 353) make it clear that the primary purpose of COOK's first and second voyages was the search for the mythical Southern Continent. COOK was instructed to explore its coast and « take possession of convenient situations in the country, in the name of the King of Great Britain. » His second voyage dispelled for all time belief in the existence of this continent. The foundations of British control over Australasia and British Columbia were laid by COOK. J. K. W.

Salomon, Wilh. Historisches über Meteoriten bei Siena (1794). *Mitt. zur Geschichte der Medizin*, 29, 135, 1930. ISIS

Seters, W. H. van. Een erfelijkheidsonderzoek in de 18de eeuw. *Bijdragen tot de geschiedenis der geneeskunde*, 10, 102-06, 1930. ISIS

« JOHANNES FLORENTINUS MARTINET (1729-1795), de bekende predikant-natuuronderzoeker, die zoovelen in binnen- en buitenland door zijn ' Katechismus der Natuur ' geboeid en men mag wel zeggen gesticht heeft, publiceerde in zijn ' Verhandelingen en waarnemingen over de Natuurlijke Historie, meerendeels van ons Vaderland ' (1795) een zeer kort artikel, dat ik, in verband met de typeerende stijl en zakelijkheid, hieronder in zijn geheel laat volgen. »

(Spallanzani, Lazaro). Municipio di Reggio nell'Emilia. Onoranze à LAZZARO SPALLANZANI nel II° centenario dalla nascita. X+459 p. Reggio nell'Emilia, Officine grafiche Reggiane, 1929. ISIS

Reviewed by GIUSEPPE MONTALENTI, *Archeion*, 11, 263-65, 1929.

D. — *Medical sciences*

Ashburn, P. M. American army hospitals of the Revolution and the War of 1812. WELCH Festschrift. *Bull. of the Johns Hopkins Hospital*, 46, 47-60, 1930. ISIS

Diepgen, Paul. ALBRECHT HALLER und die Geschichte der Medizin. GEORG STICKER Festgabe, 100-11, Berlin, SPRINGER, 1930. ISIS

Elosu, Suzanne. La maladie de JEAN-JACQUES ROUSSEAU. *Bulletin de la Société française d'histoire de la médecine*, 23, 349-56, 1929. ISIS

Jenner, Edward. An unpublished letter of EDWARD JENNER (1809). *Isis*, 13, 16-17, 1929. ISIS

Molinéry, Raymond. « Le journal de Barèges » de ANTOINE, THÉOPHILE et FRANÇOIS DE BORDEU (1730-1783). *Bulletin de la Société française d'histoire de la médecine*, 24, 30-41, 1930. ISIS

Molinéry, Raymond. La lithiase du Cardinal Prince LOUIS DE ROHAN. *Bulletin de la Société française d'histoire de la médecine*, 24, 17-23, 1930. ISIS

Nuyens, B. W. Th. PETRUS CAMPER (1722-1789) als verloskundige. *Bijdragen tot de geschiedenis der geneeskunde*, 10, 1-23, 1930. ISIS

Scarlett, E. P. JEAN PAUL MARAT, the physician as revolutionist. *Annals of Medical History*, 11, 71-9, 1930. ISIS

Viets, Henry R. The destruction of the HUNTER manuscripts. Was it an act of piety? WELCH Festschrift. *Bull. of the Johns Hopkins Hospital*, 46, 145-48, 1930. ISIS

E. — *Alia*

Coglievina, B. Dalla « Gramatica delle scienze filosofiche » di BENIAMINO MARTIN (1753). *Riv. di storia d. sc. med. e natur.*, 20, 128-31, 1929. ISIS

Sée, Henri. La philosophie de l'histoire de HERDER. *Revue de synthèse historique*, 48, 21-36, 1929. ISIS

Soret, Frédéric. Zehn Jahre bei GOETHE. Erinnerungen an Weimars klassische 1822-1832. Aus SORETS handschriftlichem Nachlass, seinen Tagebüchern und seinem Briefwechsel zum erstenmal zusam-

mengestellt, übersetzt und erläutert von H. H. HOUBEN. 799 p., 39 fig., fasc. Leipzig, BROCKHAUS, 1929. ISIS

XIXth Century (whole and first half)

B. — *Physical sciences and technology*

Bloch, M. 100 Jahre des Benzol-Problems. *Priroda*, no. 4 89-92, 1926 (Russ.). ISIS

Eine kurze historische Umschau nebst Würdigung der Bedeutung des Benzols in dem wirtschaftlichen Leben. Fast sämtliche ausländische Jubiläums-Literatur ist angegeben. M. B.

Bloch, M. LORENZO ROMANO AVOGADRO di Quaregna. Zum 150-jährigen Geburtstag. *Priroda*, no. 3, 202-05, 1927 (Russ.). ISIS

Schilderung des Menschen, seines Lebens und Wirkens, nebst genauer Literaturangabe. M. B.

Cajori, Florian. The chequered career of FERDINAND RUDOLPH HASSLER, first superintendent of the United States Coast Survey. A chapter in the history of science in America. 245 p., 3 fig., illus. Boston, CHRISTOPHER Publishing House, 1929 ($ 2). ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 120-21, 1929.

Dickmann, H. Der erste Dampfhammer. *Beiträge zur Geschichte der Technik und Industrie*, 19, 170, 1 fig., Berlin, 1929. ISIS

Enderes, Bruno. Aus den Kinderjahren der deutschen Lokomotiv-Eisenbahnen. Zustände, Männer, Taten. *Beiträge zur Geschichte der Technik und Industrie*, 19, 31-53, 25 fig., Berlin, 1929. ISIS

Forti, Umberto. TOMMASO YOUNG (1773-1829), e la rinascita della teoria ondulatoria della luce nel secolo decimonono. 1 fig. *Periodico di matematiche*, 10, 7-20, 1930. ISIS

Fourneyron, Benoit. Inventeur français (1807-1867). Notice by MAURICE DEBESSE in *Larousse mensuel*, 8, 352-3, 3 ills., 1930. ISIS

Lagunow, G. L. SADI CARNOT. *Techniko-Ekonomitschesky Westnik* no. 12, 749-51, 1926 (Russ.). ISIS

Historische Erinnerung und Betrachtung der klassischen Arbeit von SADI CARNOT (1824). M. B.

Lippmann, Edmund O. von. Ein kleiner Beitrag zur Frage HERMBSTADT-ACHARD. *Die Deutsche Zuckerindustrie*, 167, Berlin, 1930. ISIS

Menschutkin, B. N. Hundert Jahre organischer Synthese (1824-1924). *Techniko-Ekonomitschesky Westnik*, T. 4, no. 11, 763-65 (Russ.). ISIS

Eine kurze Würdigung von WÖHLER und BERTHELOT. MENSCHUTKIN weist in dieser Arbeit, wie auch in den « Nachr. d. S. Petersb. Polyt. Inst. » (mXX. 28) darauf hin, dass WÖHLERS Arbeit von 1824 schon neben der Synthese der Oxalsäure auch die Synthese des Harnstoffes enthält und dass es ein Irrtum ist, wie es üblich geschieht, dieselbe in das Jahr 1828 zu setzen. M. B.

Rothhaas, L. Der Wettkampf der Lokomotiven zu Rainhill im Oktober 1829. *Beiträge zur Geschichte der Technik und Industrie*, 19, 137-38, 2 fig., Berlin, 1929. ISIS.

Sarton, George. The discovery of the law of conservation of energy. *Isis*, 13, 18-42, 3 facs., 1929. ISIS

Contents : 1. Introductory; 2. ROBERT MAYER; 3. JAMES PRESCOTT JOULE; 4. MAYER and JOULE; 5. CARNOT, SÉGUIN, and COLDING; 6. Additional bibliography; 7. English translation of MAYER's first printed paper (1842); 8. Transcription of the page of SADI CARNOT's manuscripts reproduced in facsimile no. VII.

Facsimile no. V. J. R. MAYER : Bemerkungen über die Kräfte der unbelebten Natur (*Annalen der Chemie und Pharmacie*, 42, 233-40, Heidelberg, 1842).

Facsimile no. VI. J. P. JOULE : On the calorific effects of magneto-electricity and the mechanical value of heat (*Report of the thirteenth meeting of the British Association*, Cork, August 1843; *Transactions of the sections*, p. 33, London 1844).

Facsimile no. VII. SADI CARNOT : Manuscript note in the archives of the Academy of Sciences, Paris, Date c. 1824-32.

Swjaginzew, O. E. Akademiker B. S. JAKOBI. *Priroda*, no. 2, 115-20, 1927. ISIS

Es wird das Leben und Wirken von JAKOBI, berühmt durch seine Entdeckung der Galvanoplastik (1840), geschildert. M. B.

Weihe, Carl. ALBERT BÜRKLIN (1816-90). Ein vergessener deutscher Dichter-Ingenieur aus der Jugendzeit der badischen Eisenbahnen. *Beiträge zur Geschichte der Technik und Industrie*, 19, 121-26, Berlin, 1929. ISIS

C. — *Natural sciences*

Baratta, Mario. PALEÒCAPA e il taglio dell'istmo di Suez. *La Geografia*, 17, 3-38, 1929. ISIS

Biographical sketch of PIETRO PALEÒCAPA (1788-1869), engineer, Piedmontese Minister of Public Works, and member of the international com-

mission appointed in 1855 by SAID PASHA, Viceroy of Egypt, to study the question of the Suez Canal. J. K. W.

Bogoras, Waldemar. Le centième anniversaire des expéditions russes à l'Amérique du Sud. *Atti del XXII Congresso Internazionale degli Americanisti*, Roma, Settembre, 1926. 2, 607-617, 5 fig., Rome, 1928. ISIS

Notes on (1) the ethnographical collection made by the great Russian expedition to Central and South America under G. J. LANGSDORFF in 1824-28, and (2) the work of an expedition to Brazil and Paraguay carried out in 1914-16 by the Russian ethnologists H. H. MANISER and F. A. FIELSTRUPP, the zoölogists I. D. STRELNIKOV and N. P. TANASSYCHUK, and the economist B. S. HEIMAN. J. K. W.

Bowie, William. An early comment on isostatic compensation. *American Journal of Science*, 15, p. 433 ff., 1928. ISIS

Hoffmann, Paul. Zur Lebensgeschichte ALEXANDER VON HUMBOLDTS. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 12, 336-39, 1930. ISIS

Longwell, Chester R. HERSCHEL's view of isostatic adjustment. *American Journal of science*, 15, 451-53, 1928. ISIS

Masi, Eugenia Costanzi. Notizie di GIACOMO COSTANTINO BELTRAMI sugli indigeni americani. *Atti del XXII Congresso Internazionale degli Americanisti*, Roma, Settembre, 1926. 2, 686-96, Rome, 1928. ISIS

G. C. BELTRAMI (1779-1855) made extensive journeys in the Mississippi valley and in Mexico in the 1820s. J. K. W.

Müller, Martin. JOHANNES MÜLLERS Grundriss der Vorlesungen über Physiologie. GEORG STICKER Festgabe, 130-33, Berlin, SPRINGER, 1930. ISIS

Sawicki, Ludomir. Obristens ANTON Freiherr MAYER VON HELDENSFELD topographische Aufnahme Westgalliziens in den Jahren 1801-1804. (*Prace Instytutu Geograficznego Uniwersytetu Jagiellonskiego.* X) 112 p., maps, diag., ills. Krakow, Orbis, 1928. ISIS

An elaborate topographical survey of West Galicia was carried out in 1801-1804 under MAYER VON HELDENSFELD (1765-1842) as one of a series of military surveys of the Austrian dominions made during the reign of the Emperor JOSEPH. The results were laid down upon a manuscript map (1:28,800, in 275 sheets) and were embodied in detailed description of region. Access to these documents in the Military Archives at Vienna was obtained by SAWICKI in 1919 when serving on a Polish boundary commission. SAWICKI gives an historical sketch of cartographical development leading up to MAYER's

survey and illustrates the value of the latter to students of the history of cartographic technique in general and of the historical geography of West Galicia in particular. The following quotation is of especial interest :

« Est ist und bleibt der Hauptfehler der josephinischen Aufnahmen — und die MAYER'sche gehört im Prinzip noch zu dieser Reihe — dass sie eben auf kein mathematisches Netz aufgebaut waren, an das die Vermessungen im Feld angepasst worden wären, sondern im Gegenteil man ging von der Plankarte im Terrain aus, und erweiterte sie ohne Rücksicht auf die Erdkrümmung nach allen Seiten weiterschreitend bis zur (unbewussten) Verzerrung. Die Reaktion gegen diese Aufnahmemethode, die bei grösseren Flächen wirklich fatale Resultate ergab, erwachte jedoch erst um 1805 genügend stark, um die Regierung zu einem Bruch mit diesem System zu veranlassen und die neue, franziscäische Aufnahme auf mathematisch stichhältigere Grundlagen zu stellen. » J. K. W.

Schuster, Julius. Die Anfänge der wissenschaftlichen Erforschung der Geschichte des Lebens durch CUVIER und GEOFFROY SAINT HILAIRE. Eine historisch-kritische Untersuchung. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 12, 269-336, 1 pl., 8 fig., 1930. ISIS

Zaunick, Rudolph. OKEN, CARUS, GOETHE, zur Geschichte des Gedankens der Wirbel-Metamorphose. GEORG STICKER Festgabe, 118-29, Berlin, SPRINGER, 1930. ISIS

D. — *Medical sciences*

Beeson, B. Barker. ORFILA—pioneer toxicologist. *Annals of Medical History*, 11, 68-70, portr., 1930. ISIS

Bruck, Franz. SEMMELWEIS, nicht LISTER ! *Janus*, 33, 301-09, portr., 1929. ISIS

Le fondateur de l'antisepsie et de l'asepsie serait, non pas JOSEPH LISTER, mais IGNACE PHILIPPE SEMMELWEIS (1818-1865), à qui l'on doit en particulier la découverte, en mars 1847, de la genèse de l'infection puerpérale. (V. *infra*: VERAART, B. A. G.). L. G.

Fischer, I. Der erste Choleraeinbruch in Osterreich. Nach Akten der Wiener medizinischen Fakultät aus den Jahren 1831 und 1832. GEORG STICKER Festgabe, 134-42, Berlin, SPRINGER, 1930. ISIS

Hall, Ivan C. General and medical science one hundred years ago. *Annals of Medical History*, 11, 63-7, 1930. ISIS

Apropos of the ninth edition of GUY's Pocket Cyclopaedia (London, 1829).

Josselin de Jong, R. de. DONDERS als patholoog-anatoom. *Bijdragen tot de geschiedenis der geneeskunde*, 10, 53-72, 1930. ISIS

Krumbhaar, Edward B. JOHN CONRAD OTTO (1774-1844) and the recognition of Hemophilia (1803). WELCH Festschrift. *Bull. of the Johns Hopkins Hospital*, 46, 123-40, 3 ills., 1930. ISIS

Müller, Martin. (CARL) ROKITANSKYS Krasenlehre. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 10-39, 1930. ISIS

Müller, Reiner. ALOYS POLLENDER (1800-1879). 4 p., port. *Münchener Medizinische Wochenschrift*, Nr. 3, 114-17, 1920. ISIS

Müller, Reiner. ALOYS POLLENDER (1800-1879). 3 p., port. *Deutsche Tierärztliche Wochenschrift*, 37, 736-38, 1929. ISIS

Torkomian, Vahram H. Un manuscrit arménien sur le traitement de la peste au moyen de la fève de Saint Ignace. *Bulletin de la Société française d'histoire de la médecine*, 24, 24-29, 1930. ISIS

« C'est une brochure mince, composée de 28 pages, rédigée à Constantinople le 1er septembre 1837, par un prêtre arménien nommé Père BOGHOS (PAUL) BÉDROSSIAN. »

Veraart, B. A. G. Welche Bedeutung haben SEMMELWEIS und LISTER für den Fortschrift der Medizin? *Janus*, 33, 360-69, 1929. ISIS

L'auteur s'élève contre l'opinion de BRUCK (vide supra) qui donne trop de généralité et de portée à la découverte de SEMMELWEIS, et a le tort de ne point vouloir distinguer antisepsie et asepsie. SEMMELWEIS est resté cantonné dans le domaine de l'obstétrique; l'œuvre de LISTER a une portée qui s'est étendue à tout le domaine de la chirurgie. L. G.

Wiese, E. Robert. SEMMELWEISS. *Annals of Medical History*, 11, 80-88, 1930. ISIS

E. — *Alia*

Palhoriès, F. GIOBERTI (*Les grands philosophes*). 406 p., Paris, ALCAN, 1929. (40 fr.) ISIS

C'est à VINCENZO GIOBERTI (Turin, 1801,04,05 — Paris, 1852,11,26) qu'échut le rôle d'organisateur de la conscience nationale italienne. «Cet enfant pauvre, élevé presque par charité arrive au faîte des dignités et des honneurs; ce révolutionnaire, cet ami de MAZZINI, finit par consacrer toutes ses forces à la défense de la monarchie; ce contempteur des rois devint leur ambassadeur, leur ministre; cet homme d'action, ce politique que portent les flots de la faveur populaire, c'est un méditatif, un penseur, un philosophe; cet exilé que les princes ont chassé, les princes le rappellent comme leur soutien; ce pamphlétaire ardent, rude aux rois et à l'Église, cet ennemi juré des Jésuites, c'est un prêtre, et ce prêtre toute sa vie se posera en défenseur de la religion, et des évêques l'approuveront et des cardinaux le féliciteront »... « Logique-

ment, GIOBERTI a poussé à ses dernières conséquences l'ontologisme de ROSMINI; lui aussi il veut fonder un *système de la vérité*; il entreprend de concilier la philosophie traditionnelle de l'Église avec la pensée moderne, et c'est dans HÉGEL qu'il trouve le représentant le plus intéressant de cette pensée »... « Mais GIOBERTI n'est pas seulement un écrivain, un penseur, il est prêtre; les préoccupations d'ordre religieux ont toujours été au premier plan de ses méditations et dans toute sa vie : le voilà donc qui porte au sein même de la doctrine religieuse cette idée du devenir dont il a fait en philosophie l'une des assises de son système. Il se pose en réformateur, et tout en prétendant bien rester catholique, il émet déjà vers 1840, sur le dogme, la morale, la discipline, l'exégèse, toutes les idées avancées que l'on comprendra plus tard sous les termes généraux d'*américanisme* et de *modernisme* ». L'ouvrage de PALHORIÈS est divisé en trois parties : l'homme et le politicien, où sont donc examinées les théories sociales et politiques de GIOBERTI; le philosophe; le réformateur moderniste. L. G.

Sarton, George. Trois autographes inédits d'AUGUSTE COMTE (1826, 1847, 1850). *Isis*, 13, 103-05, pl., 1929. ISIS

XIXth Century (second half)

A. — *Mathematics*

Humbert, Georges (1859-1921). Œuvres de G. HUMBERT, publiées par les soins de PIERRE et JULIA (GASTON) HUMBERT. 555 p. Paris, GAUTHIER-VILLARS, 1929. ISIS

Reviewed by L. P., *Revue générale des sciences*, 41, 54, 1930.

Lie, Sophus. Gesammelte Abhandlungen. Band 4 : Abhandlungen zur Theorie der Differentialgleichungen. Abteilung 2. Herausgegeben von FR. ENGEL, nebst Anmerkungen. XII+ p. 449-684. Oslo, ASCHEHOUG, 1929. ISIS

Ocagne, M. d'. L'œuvre mathématique de GEORGES HUMBERT (1859-1921). *Revue des questions scientifiques*, 17, 76-82, 1930. ISIS

Picard, Emile. HENRI ANDOYER. Discours prononcé à ses obsèques le 14 juin 1929. *Annuaire du Bureau des Longitudes pour l'an* 1930. Notice D, 5 p. Paris, GAUTHIER-VILLARS, 1930. ISIS

Siacci, Francesco (1839-1907). Scritti scientifici di FRANCESCO SIACCI, pubblicati sotto gli auspici del Governo Nazionale, volume I, parte prima ; XXII+492 con ritratto. Vol. 1, parte seconda ; CI+749. Vol. II : XIII+614 : con ritratto. Roma, Provveditorato generale dello Stato, 1928. ISIS

Reviewed by ROBERTO MARCOLONGO, *Il Bollettino di Matematica*, 26, p. I-V, 1930.

B. — *Physical sciences and technology*

Anschütz, Richard. AUGUST KEKULÉ. Bd. I, Leben und Wirken. XXIV+708 S., 119 Abb., 20 Taf., Faks. Bd. 2., Abhandlungen, Berichte, Kritiken, Artikel, Reden. XVI+960 S., 5 Abb., 3 Taf. Berlin, Verlag Chemie, 1929. ISIS

Reviewed by RUDOLF WINDERLICH, *Archiv fur Geschichte der Mathematik*, 12, 339-40, 1930.

Appleyard, Rollo ; Lenard, P. CLERK MAXWELL and the MICHELSON experiment. *Nature*, 125, 566-67, 1930. ISIS

Bloch, M. VAN'T HOFF, Leben und Schaffen, Leningrad, (Wiss. Chem.-Techn. Verlag). 188 S., 1 Bildnis. ISIS

Die Monographie stellt eine Studie über den Lebens- und Schaffungsgang des berühmten Chemikers dar nebst der Bibliographie von 207 Arbeiten VAN'T HOFF's u. der Bibliographie der Arbeiten über VAN'T HOFF. M. B.

Bloch, M. Zum 50-jährigen Jubiläum der Stereochemie. *Priroda*, no. 10-12, 95-102, 1925. *Techniko-Ekonomitschesky Westnik*, 5, no. 8-9 (Russ.). ISIS

Der Aufsatz gibt eine gedrängte Uebersicht der Entwicklung der Stereochemie, wie ihrer theoretischen und praktischen Bedeutung für verschiedene Zweige der Chemie, Medizin, Technik usw. Eingehender wird der Lebensgang von VAN 'T HOFF u. LE BEL geschildert. Die Jubiläumsliteratur wird fast vollständig zitiert. M. B.

Fischer, Hugo. FREDERICK WALTON (1834-1928) und die Linoleumindustrie. *Beiträge zur Geschichte der Technik und Industrie*, 19, 133-36, 4 fig., Berlin, 1929. ISIS

Janssen, Jules. (1824-1907) Œuvres scientifiques. Recueillies et publiées par HENRI DEHÉRAIN. T. 1. VII+545 p., 12 pl. Paris, Société d'Éditions Géographiques, Maritimes et Coloniales, 1929. ISIS

Joffe, A. WILHELM KONRAD RÖNTGEN. *Fortschr. d. phys. Wiss.*, Zeitschrift unter Red. v. P. LASAREW u. E. SPOLSKI. 4, Heft 1, S. 1-10 (Russ.). ISIS

Der hervorragende russische Physiker widmet seinem Lehrer einen warm geschriebenen Nekrolog. M. B.

Kistiakowsky, W. L. « Die Theorie der elektrolytischen Dissociation von ARRHENIUS und Evolution der modernen Chemie ». Heft 6 def « Arbeiten der Komission f. Geschichte d. Wiss. », 15, 1929. (Russ.). ISIS

Einer d. eifrigsten, frühesten und selbständigsten Förderer der ARRHENIUS' schen Ideen, Akad. KISTIAKOWSKY, gibt in gedrängter Form ein Bild der Entwicklung der elektrolytischen Dissociationstheorie und deren Anwendung in verschiedenen Fragen, speziell auch im Gebiete der Kolloidchemie. M. B.

Kurilow, A. N. Dem Andenken von W. WITKOWSKY. *Fortschr. d. physik. Wiss.* Red. von P. LASAREW u. E. SPOLSKI, 4, Heft 6, 429-31, (Russ.). ISIS

Kurze Schilderung der Arbeiten des hervorragenden russischen Geodesisten und Astronomen WASSILI WASSILJEWITSCH WITKOWSKI. M. B.

Lebedinsky, W. K. A. S. POPOW, der Erfinder der drahtlosen Telegraphie. *Techniko-Ekonomitschesky Westnik.* Bd. 5, no. 7, 465-67. ISIS

Lebens- und Schaffens-Schilderung des hervorragenden russischen Erfinders, Gelehrten u. Technikers. MARCONIS Ruhm hat ihn zeitweise in den Schatten gestellt. 1909 gründete die Russ. Phys.-Chem. Ges. eine besondere Kommission, an der die hervorragendsten Physiker j. Z. — CHWOLSON, GOLYZIN — teilnahmen und die im Einverständnis mit LODGE, BRANLY die Selbständigkeit der POPOW'schen Entdeckung anerkannte. Das 30-jährige Jubiläum wurde am 7. V. 1925 in Moskau und Leningrad gefeiert. Eine Reihe spezieller Journäle, wie *Elektrizität* etc. haben spezielle Hefte dem Jubiläum gewidmet. M. B.

Pflieger-Haertel, Hermann. FRIEDRICH v. VOITH (1840-1913) und sein Werk. Die Gründung und Entwicklung der Firma J. M. VOITH, Heidenheim Brenz (Wttb.) und St. Pölten (Niederösterr.). *Beiträge zur Geschichte der Technik und Industrie*, 19, 61-70, 12 fig., Berlin, 1929. ISIS

Pupin, Michael. Vom Hirten zum Erfinder. Aut. dtsch. Übers. von JESSY SCHMIDT. Mit Bildnis des Verf. u. 1 Tfl. 390 p. Leipzig, MEINER, 1929. ISIS

Translation of PUPIN's brilliant autobiography (1923), which was reviewed in *Isis*, 7, 135-38. Reviewed by E. DARMSTAEDTER in *Mitteilungen zur Geschichte der Medizin*, 29, 61, 1930.

Schoof, Fr. Entwicklung von einigen wichtigen elektrischen Installations-Apparaten. *Beiträge zur Geschichte der Technik und Industrie*, 19, 99-112, 62 fig., Berlin, 1929. ISIS

Schück, H., Sohlman, R. The life of ALFRED NOBEL. Translated from the German of W. H. v. D. MUELBE by BRIAN and BEATRIX LUNN. IX+353 p., 18 pl. London, HEINEMANN, 1929. ISIS

Reviewed in *Nature*, 125, 495-97, 1930.

Smith, Edgar Fahs (1854-1928). CHARLES MAYER WETHERILL, 1825-1871. IX+83 p., pl. Reprinted from the *Journal of Chemical Education*, 1929. ISIS

Extensive biography of the Philadelphian, C. M. WETHERILL, who was consulting chemist in Philadelphia, later at Lafayette, Indiana, at the Department of agriculture, the Smithsonian Institution, and finally professor of chemistry in Lehigh University, Bethlehem. This was the last work of the much lamented author and was left by him in the form of a sketch. The sketch was completed by C. A. BROWNE, helped by RICHARD B. WETHERILL, son of the subject of this biography. Many documents are reproduced in extenso; abundant illustrations. G. S.

Smith, Edgar Fahs (1854-1928). Memorial service for EDGAR FAHS SMITH, the provost of the University of Pennsylvania presiding. William B. Irvine auditorium, University of Pennsylvania, December 4, 1928. 62 p., port. ISIS

Addresses by FRANCIS XAVIER DERCUM, MARSTON TAYLOR BOGERT, JOSIAH HARMAR PENNIMAN. This beautiful little volume devoted to the memory of the much lamented president of the History of Science Society (1928) will help to keep it green in the hearts not only of the many men whose privilege it was to know him but also of many more who were less fortunate. I may recall that a biography of his, with portrait and bibliography, was published by C. A. BROWNE in *Isis*, 11, 375-84, 1928. G. S.

C. — *Natural sciences*

Billard, Armand. JULES WELSCH (1858-1929). *Revue scientifique*, 68, 7-8, 1930. ISIS

Jones, Leonard Chester. ARNOLD GUYOT et Princeton. (*Université de Neuchatel : Recueil de travaux publiés par la Faculté des Lettres.* Quatorzième fascicule). 125 p. Neuchatel, Secrétariat de l'Université, 1929. ISIS

Before coming to America in 1849 on the invitation of his compatriot, LOUIS AGASSIZ, GUYOT (1807-1884) had established a reputation at home for his studies of the movements of Alpine glaciers and of the former extent of glaciation on the northern and southern flanks of the Alps. After he had settled permanently in America his most striking contributions to science lay in the field of meteorology. The well known *Smithsonian Meteorological and Physical Tables* were first compiled by GUYOT, and he was the first to suggest the possibility of utilizing telegraphic reports of simultaneous observations as a basis for weather forecasting. In his lectures and publications, particularly in the volume *The Earth and Man*, published in 1849, he stressed the dependence of human life on geographical circumstances. In 1849 he « définit nettement son idée de la position de l'homme dans l'univers — idée conforme aux doctrines du christianisme orthodoxe — et sur les

rapports entre la science et la religion : L'homme... est le terme et le but de toute la création. Certainement il en est ainsi. La foi nous l'enseigne. La science nous en instruit. » Nevertheless toward the end of his life he was ready to accept, with reservations, the doctrine of evolution by natural causes. His success, in JONES' opinion, was due to the high quality of his scientific work rather than to his religious orthodoxy, as other critics have implied.

In 1855 GUYOT became Professor of Geology and Geography at Princeton, a position which he occupied until his death. JONES' scholarly volume is essentially a biography of GUYOT during the Princeton period, although enough is told of his earlier career to give an adequate view of GUYOT's life as a whole. J. K. W.

Lampugnani, Giuseppe. UGO FERRANDI. *La Geografia*, 17, 38-63, 1929. ISIS

Biographical note on UGO FERRANDI (1852-1928), who carried out important explorations in Abyssinia and Italian Somaliland in the eighteen nineties. J. K. W.

Leidy, II, Joseph. Ceremonial attending the opening of the Down House, England, the home of CHARLES DARWIN. *Science*, September 1929. Reprinted in *Medical Searchlight*, Philadelphia, 1930, 17-23. ISIS

Mettrier, Henri. Une grande figure d'alpiniste et d'historien. W. A. B. COOLIDGE. *Comité des Travaux Historiques et Scientifiques : Bulletin de la Section de Géographie*, 43, 141-207, 1928. ISIS

The Rev. W. A. B. COOLIDGE (1850-1926) was one of the most enthusiastic Alpinists of the last century and an outstanding authority on the history and topography of the Alps and on the history of mountaineering. Besides innumerable lesser studies, he was the author of two substantial volumes; JOSIAS SIMLER et les origines de l'alpinisme avant 1600, 1904, and The Alps in nature and history, 1908. J. K. W.

Omeljanski, W. L. SERGEI NIKOLAJEWITSCH VINOGRADSKI. Zu seinem 70 jährigen Geburtstag. *Priroda*, no. 1, 3-10, 1927 (Russ.). ISIS

Der bekannte russische im vorigen Jahre gestorbene Gelehrte schildert in der ihm eigenen fesselnden Weise den Lebensgang seines Lehrers, des berühmten Mikrobiologen WINOGRADSKI. Er hat die Pasteurischen Ideen in der Biochemie der Mikroben weiter entwickelt. Seine Untersuchungen der S u. Fe-Bakterien (1885-1888) in Strassburg im botanischen Laboratorium, haben schon früh die Aufmerksamkeit auf ihn gelenkt. Ruhm brachten ihm seine Arbeiten über die Nitrifikation (1888-1890), die er in Zürich ausführte. 1891-1912 arbeitete er in Petersburg, 1902-1905 — Direktor des Inst. f. experimentelle Medizin. 1912 verliess er seine Heimat; trotz seines hohen Alters arbeitet er rüstig als Direktor des Agro-Bakteriologischen Laboratoriums des Pasteurischen Instituts in Brie-Comte-Robert, 30 Kilometer von Paris. M. B.

D. — *Medical sciences*

Diepgen, Paul. Die deutsche Medizin und Gynäkologie im Zeitalter der wissenschaftlichen Anfänge von ALFRED HEGAR (1852-1864). 16 p. Sonderabdruck aus der *Deutschen Medizinischen Wochenschrift*, Nr. 2 u. 3, 1930. ISIS

Pleadwell, Frank Lester. NINIAN PINKNEY, M. D. (1811-1877) surgeon United States Navy. *Annals of Medical History*, 2, 89-121, 5 fig., 1930. ISIS

Roos, Joseph. THEODOR BILHARZ. Würzburger Diss. 55 p., 1929. ISIS

Veraart, B. A. G. SEMMELWEIS en LISTER. *Bijdragen tot de geschiedenis der geneeskunde*, 10, 89-102, 1930. ISIS

E. — *Alia*

Helmholtz, Anna von. Ein Lebensbild in Briefen. Hrsg. von ELLEN VON SIEMENS-HELMHOLTZ. I. Bd. 344 S.; II. Bd. 266 S. 6 Taf. Berlin, Verlag f. Kulturpolitik, 1929. ISIS

Die Tochter entrollt hier ein umfangreiches Bild dieser vornehmen, bedeutenden Frau, indem sie die Briefe mit (manchmal zu knappem) Zwischentext versah. Für uns handelt es sich nicht um die Frau selbst (Tochter von ROBERT v. MOHL), sondern um HELMHOLTZ und seine Freunde, wie BUNSEN, KIRCHHOFF, DARWIN, FARADAY und viele andere. Wissenschaftlich wird man Neues nicht finden, aber viel Persönliches und Menschliches, geeignet die HELMHOLTZ biographie von KÖNIGSBERGER zu ergänzen. Gleichzeitig ist das Werk ungewollt eine glänzende Kulturgeschichte der Zeit von 1850 bis 1900. H. W.

XXth Century

A. — *Mathematics*

Nikiforow, P. M. W. A. STEKLOW (1863-1926). *Priroda*, no. 9-10, 3-20, 1926 (Russ.). ISIS

Ein sehr warm geschriebener Nekrolog über den frühzeitig verstorbenen bekannten Mathematiker, Vice-Präsidenten der Akad. d. Wissenschaften d. USSR. M. B.

Weyl, Hermann. FELIX KLEINS Stellung in der mathematischen Gegenwart. *Die Naturwiss.*, 18, 4-11, 1930. ISIS

B. — *Physical sciences and technology*

Bloch, Eugène. L'ancienne et la nouvelle théorie des quanta. 418 p., 42 fig., HERMANN et Cie, Paris, 1930 (90 fr.). ISIS

Agée d'à peine trente ans, la théorie des quanta, née d'un mémoire de MAX PLANCK sur la répartition de l'énergie dans le spectre du corps noir, a déjà devant elle toute une histoire, que marquent les travaux d'EINSTEIN sur l'effet photoélectrique (1905), sur les chaleurs spécifiques des corps solides (1907), de N. BOHR sur la structure de l'atome et l'émission des raies spectrales (1913), qui a décidé du triomphe des théorie quantiques. Grâce aux travaux de SOMMERFELD, EPSTEIN, PAULI, LANDÉ, HEISENBERG, HUND, BORN,... la théorie des quanta a envahi peu à peu la physique toute entière, réunissant par des liens étroits l'émission des séries de raies spectrales, l'émission des spectres de bandes et des spectres de rayons X, les effets ZEEMAN et STARK, le magnétisme atomique, la structure périodique des éléments et leurs propriétés chimiques, etc. Des difficultés subsistaient cependant qui, d'abord négligées, finissaient par exiger impérieusement une solution. Et c'est ainsi que débutait en novembre 1924 la *nouvelle théorie des quanta*, par un mémoire publié par LOUIS DE BROGLIE comme thèse de doctorat (*Ann. de physique*, 3, 32, sq.) où se trouvait introduite l'idée des ondes « associées » au mouvement d'un point matériel, et établie une correspondance entre le principe de MAUPERTUIS, forme particulière du principe d'HAMILTON, considéré comme principe fondamental de la mécanique, et le principe de FERMAT, considéré comme principe fondamental de l'optique géométrique. Ces principes de LOUIS DE BROGLIE ont été généralisés dans une belle série de mémoires publiés coup sur coup par E. SCHRÖDINGER à partir de février 1926 aux *Annalen der Physik* (réunis dans Abhandlungen zur Wellenmechanik, 2e Aufl., BARTH, Leipzig, 1928), et qui, repris et développés par toute une série de chercheurs, constituent aujourd'hui le corps de doctrine imposant connu sous le nom de *mécanique ondulatoire*. Parallèlement à la mécanique ondulatoire, et tout-à-fait indépendamment d'elle au début, s'est développée une autre mécanique quantique, basée sur un mémoire de W. HEISENBERG, publié en juillet 1925 (*Zschrift f. Physik*, 33, 879), la *mécanique des matrices*. Les deux théories, qui semblent au premier aspect présenter des oppositions fondamentales, ne sont, comme l'a montré SCHRÖDINGER, que deux aspects différents de la même réalité; loin de se contredire, elles se complètent très heureusement. Enfin, au cours de l'été 1927, HEISENBERG (*Zschr. f. Physik*, 43, 172) énonçait le « principe d'indétermination », qui faisait entrer, grâce surtout aux conséquences qu'en a tirées BOHR, la théorie quantique dans une nouvelle phase.

L'ouvrage de BLOCH est divisé en 20 chapitres. Les dix premiers sont consacrés à la théorie des quanta sous sa forme primitive; les chapitres 11 et 12 forment transition et préparent les huit derniers qui traitent des théories quantiques récentes. L. G.

Bloch, M. Dem Andenken von L. TSCHUGAEW. *Priroda*, Bd. 11, no. 8-9, 97-102 (Russ.). ISIS

In gedrängter Form werden der Lebensgang und die wichtigsten Arbeiten des frühzeitig verstorbenen hervorragenden russischen Chemikers gegeben. M. B.

Bloch, M. A. Die Entwicklung der russischen Chemie im zwanzigsten Jahrhundert. *Beiträge zur Geschichte der Technik und Industrie*, 19, 147-50, Berlin, 1929. ISIS

Bloch, M. MAX PLANCK. Zum 25-jährigen Jubiläum der Quanten-Hypothese. *Priroda*, no. 3-4, 31-10, 1926 (Russ.). ISIS

Kurze Schilderung des Lebensganges, der Arbeiten und der Persönlichkeit des berühmten Physikers nebst einem ausführlichen Verzeichnis der Literatur über ihn. M. B.

Broglie, L. de, Foëx, G., et autres. — Conférences d'actualités scientifiques et industrielles, faites au Conservatoire national des arts et métiers en 1929. Préface de J. LEMOINE. VIII+272 p., ill. HERMANN et Cie, Paris, 1930. ISIS

Voici les titres de ces conférences, toutes relatives à la science qui se fait : LOUIS DE BROGLIE : Une crise récente de l'optique ondulatoire (naissance de la mécanique ondulatoire, 1924; diffraction des électrons par les cristaux); G. FOËX : Les substances mésomorphes, leurs propriétés magnétiques; E. BLOCH : Les atomes de lumière et les quanta; L. DUNOYER : La cellule photoélectrique et ses applications; G. RABAUD : Le rayonnement des corps incandescents; températures apparentes de brillance, de radiation et de couleur; mesure optique des températures; Colonel JULLIEN : Application du courant électrique, des oscillations radio-électriques et des phénomènes photo-électriques à la réalisation d'instruments de musique; LÉON BLOCH : Structure des spectres et structure des atomes; V. KAMMERER : Les hautes pressions de vapeur; R. MESNY : Les ondes dirigées et leurs applications. L. G.

Broglie, Louis de. Recueil d'exposés sur les ondes et les corpuscules. 82 p.; 1 portr., HERMANN & Cie, Paris, 1930 (20 fr.). ISIS

Ce recueil contient cinq exposés faits par LOUIS DE BROGLIE depuis novembre 1927, et qui ont trait à la question des ondes et des corpuscules, et à la mécanique ondulatoire. 1° La physique et l'œuvre de FRESNEL (*Isis*, 12, 378); 2° Ondes et corpuscules dans la physique actuelle (communication faite à Glasgow devant l'Association britannique pour l'avancement des sciences, en septembre 1928, reprise comme introduction dans l'ouvrage ci-dessous); 3° La crise récente de l'optique ondulatoire (*v. supra* : DE BROGLIE, FOËX, etc.); 4° Comme la lumière, les électrons peuvent interférer; 5° Déterminisme et causalité dans la physique contemporaine. — On sait que l'auteur, né à Dieppe en 1892, a obtenu en 1930 le prix Nobel pour la physique en raison précisément de ses travaux sur les ondes et les corpuscules et de sa création de la mécanique ondulatoire. L. G.

Broglie, Louis de. Introduction à la mécanique ondulatoire, XVI+292 p., ill., portr. de l'auteur. HERMANN & Cie, Paris, 1930 (85 fr.). ISIS

Cet ouvrage a pour objet de montrer comment se fait le passage de l'ancienne à la nouvelle mécanique imaginée par l'auteur vers 1924, et développée par E. SCHRÖDINGER, W. HEISENBERG, N. BOHR (*v. supra*, BLOCH), et d'expliquer pourquoi ce passage entraîne des modifications importantes de nos conceptions générales sur la nature des lois physiques, modifications qui découlent essentiellement du principe d'indétermination de HEISENBERG. L. G.

(Ipatjew, W.) Zum 35-jährigen Jubiläum der wissenschaftlichen Tätigkeit des Akademikers W. IPATJEW. 172 p., port. Leningrad. Wiss. Chem. Techn. Verlag, 1928 (Russ.). ISIS

Von deutschen Gelehrten nahmen teil : R. WILLSTÄTTER, G. BREDIG und K. FAJANS ; von fronzösischen schrieb CAMILLE MATIGNON einen Artikel. Es folgen die Begrüssungsansprachen der verschiedenen Gelehrten und Staatsanstalten des In- und Auslandes. Zum Schluss ein Verzeichniss sämtlicher Arbeiten IPATJEWS. M. B.

Lorentz, Henrik Antoon (1853-1928). Vue générale de la physique moderne. Discours prononcé au Congrès international de physique, Como, 1927. *Periodico di matematiche*, 8, 229-38, 1928. ISIS

Sano, Shizuwo (1872-1925). Scientific papers. XII+340 p., port. Tôkyô, SHOTEN, 1926. ISIS

With a short biography of SANO by Y. URAGUCHI.

Schubnikow, A. W. I. W. WULF. *Priroda*, no. 1-2, 5-8, 1926 (Russ.). ISIS

Am 25. XII. starb im 63 Jahre einer der hervorragendsten Kristallographen, korrespondierendes Mitglied der Akad. der Wissenschaften. Dei Artikel gibt in gedrängter Form eine Würdigung seiner wissenschaftlichen Arbeiten. M. B.

Wolfkowitsch, S. I. I. W. SAMOILOW (1870-1925). *Techniko-Ekonomitschesky Westnik*, 5, 845-53 (Russ.). ISIS

Eine Schilderung des Lebensganges und Würdigung der Arbeiten des hervorragenden russischen Mineralogen und Geologen. M. B.

C. — *Natural sciences*

Berg, L. N. M. KNIPOWITSCH. Zum 40-jährigen Jubiläum seiner wissenschaftlichen Arbeit. *Priroda*, no. 3-4, 11-16, 1926 (Russ.). ISIS

Artikel gibt ein Bild des Lebensganges und der mannigfaltigen Arbeiten des hervorragenden Forschers des Weissen, Barenzowo, Kaspischen, Baltischen, Azowschen und Schwarzen Meeres. M. B.

Cherry-Garrard, Apsley. The worst journey in the world : Antarctic, 1910-1913. Second edition. In 2 volumes. Vol. 1, XIV+300 p. Vol. 2, p. VIII+301—585. London, CONSTABLE, 1929. ISIS

Filiptschenko, I. BATESON. *Priroda*, no. 11-12, 69-74, 1926 (Russ.). ISIS

Ein sehr warm geschriebener Nekrolog des berühmten Biologen. M. B.

Joerg, W. L. G. The work of the BYRD antarctic expedition, 1928-1930. 71 p., 16 maps. New York, American Geographical Society, 1930. ISIS

Lasarew, P. JACQUES LOEB. *Fortschr. d. Physik. Wissensch.* 4, Heft 4-5, 325-28 (Russ.). ISIS

P. LASAREW würdigt in gedrängter Form die Lebensarbeit des berühmten amerikanischen Physiologen und Biologen. M. B.

Shosaburo Watasé (1862-1929). Obituary by F. R. LILLIE and SHIGEO YAMANOUCHI. *Science*, 71, 577-78, 1930. ISIS

D. — *Medical sciences.*

Pletnew, Dimitri D. L. A. TARASSEWITSCH. Zu seiner Charakterisierung. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 91-96, 1930. ISIS

(Sticker, Georg.) GEORG STICKER. Zu seinem 70. Geburtstag am 18. April 1930. Sonderdruck aus der *Münchener medizinischen Wochenschrift*, p. 3-9, 1930. ISIS

Welch, William H. The WILLIAM H. WELCH Medical Library of the Johns Hopkins University. An account of its origin and development together with a description of the building and an account of the exercises held on the occasion of the dedication of the Library and the inauguration of the Chair of the History of Medicine at the Johns Hopkins University, Baltimore, Maryland, October 17 and 18, 1929. VII+153 p., ills. *Bulletin of the Johns Hopkins Hospital*, vol. 46, no. 1, January, 1930. ISIS

Full account of the admirable WELCH Medical Library in Baltimore, with various contributions by LEWIS H. WEED, EDWARD LIPPINCOTT TILTON, JOSEPH S. AMES, BLANCHARD RANDALL, HARVEY CUSHING, KARL SUDHOFF, ARCHIBALD MALLOCH, W. W. FRANCIS, LEONARD L. MACKALL, ABRAHAM FLEXNER, STEPHEN D'IRSAY, EDWARD B. KRUMBHAAR, EDWARD C. STREETER, JOHN R. OLIVER, HENRY R. VIETS, and many illustrations including excellent portraits of WELCH and SUDHOFF. See our note in *Isis*, 14, 423, devoted to the Welch Jubilee of Washington (April 8, 1930). The chair of the History of Medicine founded at Johns Hopkins is the earliest in America, and one of the earliest in the world. With Dr. WELCH as its first incumbent it inaugurates a new tradition which we hope will be a glorious one. Some of the articles of this Festschrift are separately included in the present bibliography each in its proper place. G. S.

PART II

HISTORICAL CLASSIFICATION

Including only the items which could not be included in Part I — the fundamental (centurial) classification. Hence a student of Muslim science, for example, should not peruse simply the notes collected below under the heading « Islam », he should examine as well those included above under the headings VIIth century, VIIIth century, etc.

CONTENTS :

I. — *Antiquity* : 1. Antiquity (generalities); 2. Egypt; 3. Babylonia and Assyria ; 4. Greece ; 5. Rome.
II. — *Middle Ages* : 6. Middle Ages (generalities) ; 7. Byzantium.
III. — *Oriental Science and Civilization* : 8. Asia (generalities ; Western Asia ; Central Asia ; Eastern Asia) ; 9. India ; 10. China ; 11. Japan ; 12. Israel ; 13. Iran ; 14. Islam.

I. ANTIQUITY

1. — ANTIQUITY *(generalities)*

Angus, Samuel. The religious quests of the Graeco-Roman world. A study in the historical background of early Christianity. XX+444 p. London, MURRAY, 1929. ISIS

Artelt, Walter. Geschichte der Anatomie der Kiefer und der Zähne bis zum Ausgang der Antike. *Janus*, 33, 199-212, 310-36, 1929. ISIS

Les Babyloniens, Assyriens, Egyptiens connaissaient la présence du sang dans la dent; les Egyptiens ont fait d'excellentes observations anatomiques de la bouche. Les Hindous sont le seul peuple de l'antiquité qui connaisse la diversité des substances constitutives de la dent. Les hippocratiques font de bonnes observations sur la forme des dents et ont une théorie approfondie du développement de la dent. ARISTOTE connait la pénétration des vaisseaux dans la dent. Ultérieurement la nomenclature de l'anatomie des dents et de la bouche est améliorée, notemment par MÉNON et RUFUS D'EPHÈSE.
L. G.

Bakker, C. Iets over den invloed van EMPEDOCLES en ARISTOTELES op de geneeskunde en de magie bij de oude Grieken en Romeinen. *Bijdragen tot de geschiedenis der geneeskunde*, 10, 29-44, 1930. ISIS

Baur, V. C. ; Rostovtzeff, M. I. The excavations at Dura-Europos,

conducted by Yale University and the French Academy of Inscriptions and Letters. Preface by JAMES R. ANGELL. X+77 p. New Haven, Yale University Press, 1929. ISIS

Reviewed by HAROLD N. FOWLER, *American Historical Review*, 35, 318, 1930.

Beardsley, Grace Hadley. The Negro in Greek and Roman civilization. A study of the Ethiopian type. XII+145 p., figs. (*The Johns Hopkins Univ. Studies in Archaeology*, ed. by DAVID M. ROBINSON, no. 4.). Baltimore, The Johns Hopkins Press, 1929. ISIS

Reviewed by JOSEPH VOGT, *Deutsche Literaturzeitung*, 1, 752-53, 1930; by A. D. FRASER, *The Art Bulletin*, 11, 426-27, 1929.

Bilabel, Friedrich. Geschichte Vorderasiens und Ägyptens vom 16.-11. Jahrhundert vor Chr. XX+475 p., 2 maps, Heidelberg, WINTER, 1927. ISIS

Reviewed by JULIUS LEWY, *Deutsche Literaturzeitung*, 5, 2319-22, 1928.

Borovka, Gregory Iosifovich. Scythian art. Translated from the German by V. G. CHILDE. 111 p., 74 pl. London, BENN, 1927. ISIS

Reviewed by G. W. M., *Journal of the Royal Asiatic Society*, 971-3, 1928.

Fougères, Gustave ; Contenau, Georges ; Grousset, René ; Jouquet, Pierre ; Lesquier, Jean. Les premières civilisations. (Peuples et civilisations, histoire générale, publiée sous la direction de LOUIS HALPHEN et PHILIPPE SAGNAC.) Deuxième édition. VII+477 p. Paris, ALCAN, 1929. ISIS

Reviewed by ROBERT W. ROGERS, *American Historical Review*, 35, 389, 1930.

Haberling, Wilhelm. Das Reiten ein Heil- und Gesundungsmittel im klassischen Altertum. GEORG STICKER Festgabe, 18-21, Berlin, SPRINGER, 1930. ISIS

Heiberg, Johan Ludvig (1854-1928). Fra Hellas og Italien. Udvalgte Afhandlinger. 2. Bde. XI+495 + 420 p., figs. Kopenhagen, JESPERSEN & PIO, 1929. ISIS

Reviewed by U. v. WILAMOWITZ-MOELLENDORFF, *Deutsche Literaturzeitung*, 1, 15-17, 1930.

Hennig, Richard, Die liparischen Inseln im Lichte der antiken Sagenwelt. *Geographische Zeitschrift*, 35, 546-59, 1929. ISIS

Hermann, Albert. Irrtümliche Namensversetzungen : Die Herkunft der Namen Rotes Meer, Ägypten und Phönizien aus dem tritonischen

Kulturkreis. *Beiträge zur historischen Geographie, Kulturgeographie, Ethnographie und Kartographie, vornehmlich des Orients*, hrsg. von HANS MZIK, p. 112-43, 2 maps. Leipzig, DEUTICKE, 1929. ISIS

HERMANN seeks to trace the origin of the names Erythraean Sea, Egypt, Nile, Thebes, Phoenicia, and Tyre to an ancient cultural center in what is now southern Tunisia, where these names may have been used to designate very different localities from those to which they later became attached. The debt of Greek civilization to this « Tritonic » culture has, perhaps, been inadequately recognized. J. K. W.

Hornyánszky, Julius. Von HIPPOKRATES bis TACITUS. 24 p. Pécs, Ungarn, 1929. ISIS

« Milieutheorie » bei HIPPOKRATES, POSEIDONIOS, und TACITUS. E. H.

Kubitschek, Wm. Grundriss der Antiken Zeitrechnung. IX+232 p., illus. BECK'sche Verlagsbuchhandlung, München, 1928 (16 Marks, bound). ISIS

Reviewed by H. G. BÉVENOT, *Isis*, 13, 121-22, 1929.

Lucas, A. Silver in ancient times. *Journal of Egyptian Archaeology* 14, 313-19, 1928. ISIS

Mühl, Max. Die antike Menschheitsidee in ihrer geschichtlichen Entwicklung. (*Das Erbe der Alten. Schriften über Wesen und Wirkung der Antike*. 2. Reihe, gesamm. und hrsg. von OTTO IMMISCH, 14). XI+144 p. Leipzig, DIETERICH, 1928. ISIS

Reviewed by VICTOR EHRENBERG, *Deutsche Literaturzeitung*, 6, 129-36, 1929.

Müller, Valentin. Frühe Plastik in Griechenland und Vorderasien. Ihre Typenbildung von der neolithischen bis in die griechisch-archaische Zeit (rund 3000 bis 600 v. Chr.) X+248 p., 452 fig. Augsburg, FILSER, 1929. ISIS

Reviewed by GEORG LIPPOLD, *Deutsche Literaturzeitung*, 1, 163-69, 1930.

Neugebauer, Otto. Über vorgriechische Mathematik. 18 p. (*Hamburger mathem. Einzelschriften*, Heft 8). Berlin, TEUBNER, 1929. ISIS

Rostovtzeff, M. I. The animal style in South Russia and China: being the material of a course of lectures delivered in August, 1925, at Princeton University under the auspices of the Harvard-Princeton Fine Arts Club. XVI+112 p., 33 pl. Princeton, Princeton University Press, 1929. ISIS

Rostovtzeff, M. I. Le centre de l'Asie, la Russie, la Chine et le style

animal. *Σκυθικά* A'. Prag, Seminarium Kondakovianum, 1929. ISIS

Segrè, Angelo. Metrologia e circolazione monetaria degli antichi. XIV+546 p. Bologna, ZANICHELLI, 1928. ISIS

Reviewed by FRITZ HEICHELHEIM, *Deutsche Literaturzeitung*, 5, 2414-16, 1928.

Stéphanidès, Michel. L'essai des substances chez les anciens. *Archeion*, 11, 375-94, 1929. ISIS

Stuart, Duane Reed. Epochs of Greek and Roman biography. VII+270 p. (Sather Classical Lectures. vol. 4, 1928). Berkeley, Univ. of California Press, 1928. ISIS

Reviewed by WOLDEMAR Graf UXKULL-GYLLENBAND, *Deutsche Literaturzeitung*, 6, 2450-53, 1929.

Toutain, Jules. The economic life of the ancient world. Translated by M. R. DOBIE. XXVII+361 p. *(The history of civilization series.)* London, KEGAN PAUL, 1930. ISIS

Willoughby, Harold Rideout. Pagan regeneration: a study of mystery initiations in the Graeco-Roman world. XII+307 p. Chicago, University of Chicago Press, 1929. ISIS

2. — EGYPT

Baikie, James. A history of Egypt. From the earliest times to the end of the XVIIIth dynasty. In two volumes. Vol. I, XII+426 p. Vol. II. VIII+403 p. London, BLACK, 1929. ISIS

Bissing, Fr. W. von. La plus ancienne monnaie? (*Forschungen und Fortschritte*, I, 9, 1929). French translation in *Chronique d'Egypte*, 5, p. 102, 1930. ISIS

Brunton, Guy; Caton-Thompson, Gertrude. The Badarian civilization and predynastic remains near Badari. X+128 p., 85 pl. (British School of Archaeology in Egypt and Egyptian Research Account Thirtieth year, 1924). London, QUARITCH, 1928. ISIS

Capart, Jean. Lectures on Egyptian art. XXXII+290 p. Chapel Hill, N. C., University of North Carolina, 1928. ISIS

Capart, Jean. Memphis. A l'ombre des pyramides. Avec la collabo-

ration de MARCELLE WERBROUCK. XVII+413 p., 391 fig. Paris, VROMANT, 1930. ISIS

Cette nouvelle publication du grand animateur de l'Égyptologie n'est pas moins précieuse que les précédentes. Elle contient près de 400 illustrations évoquant tous les aspects de l'âge des pyramides. Le texte même est fort intéressant; c'est de la haute vulgarisation du meilleur aloi. La réflexion suivante me parait fort juste (p. 277) : « Si vraiment l'art ne doit son origine qu'à des pratiques religieuses et magiques, on aurait le droit de dire que l'invention de l'écriture représente un cas spécifique de laïcisation de l'art. » Mon seul regret c'est que la dimension des objets illustrés ne soit pas indiquée. S'il était convenu de n'indiquer par ex. que la hauteur, cette indication ne prendrait que fort peu de place et donnerait souvent une grande satisfaction au lecteur. G. S.

Clarke, Somers; Engelbach, R. Ancient Egyptian masonry. 269 ills. Oxford University Press, 1930. ISIS

Davies, N. de Garis. A peculiar form of new kingdom lamp. *Journal of Egyptian Archaeology*, 10, 9-14, 3 pl., 1924. ISIS

Dawson, Warren R. Note on the Egyptian papyrus boat. *Journal of Egyptian Archaeology*, 10, p. 46, 1 pl., 1924. ISIS

Dawson, Warren R. Making a mummy. *Journal of Egyptian Archaeology*, 13, 40-49, 3 pl., fig., 1927. ISIS

Dawson, Warren R. The plant called « hairs of the earth ». *Journal of Egyptian Archaeology*, 12, 240-41, 1926. ISIS

« I think that we may with great probability, provisionally at least, equate the « hairs of the earth » with the Fenugreek. Fenugreek is still an official drug, although its principal uses to-day are in veterinary medicine and as a flavouring element in curry powders, etc. Throughout the Middle Ages, and in the later Herbals and Dispensatories, the drug is prescribed for the same purposes as in the medical papyri of Egypt. »

Dawson, Warren R. Some observations on the Egyptian calendars of lucky and unlucky days. *Journal of Egyptian Archaeology*, 12, 260-64, 1 pl., 1926. ISIS

Ebbell, B. Die ägyptischen Krankheitsnamen. *Z. ägypt. Sprache u. Altertumskde.* 64, 117-22, 1929. ISIS

Erman, Adolf. Mein Werden und mein Wirken. Erinnerungen eines alten Berliner Gelehrten. VIII+295 p. Leipzig, QUELLE u. MEYER, 1929. ISIS

Reviewed by GEORG STEINDORFF, *Deutsche Literaturzeitung*, 1, 1-6, 1930.

Glanville, S. R. K. Daily life in ancient Egypt. VI+74 p. (*Routledge introductions to modern knowledge*, no. 16). London, ROURTLEDGE, 1930. ISIS

Glanville, S. R. K. A note on HERODOTUS II, 93. *Journal of Egyptian Archaeology*, 12, 75-76, 2 pl., 1926. ISIS

Apropos of the « fish that go in shoals. »

Griffith, F. Ll. A drinking siphon from Tell el-'Amarnah. *Journal of Egyptian Archaeology*, 12, 22-23, 2 fig., 1926. ISIS

Hall, H. R. (1873-1930). Scarabs. 16 p., 4 pl., 33 figs. London, British Museum, 1929. ISIS

Hurry, Jamieson B. (1857-1930). Imhotep, the vizier and physician of King Zoser and afterwards the Egyptian god of medicine. Second and revised edition. XVI+211 p., 26 illus. Oxford Press, HUMPHREY, MILFORD, 1928. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 373-75, 1930.

Lucas, A. Copper in ancient Egypt. *Journal of Egyptian Archaeology*, 13, 162-70, 1927. ISIS

« In view of the statements that have been made that copper was probably not discovered in Egypt, but in Asia, and that the Egyptian copper mines could not have supplied the amount of that metal used in the country anciently, it seems desirable to summarize what is known about the Egyptian copper deposits and their early working. Copper ore occurs within the geographical limits of modern Egypt in two different localities, namely in Sinai and in the eastern desert. The amount, however, is not sufficiently large to warrant mining at the present day, since copper may be obtained in much greater quantity and in more easily accessible places elsewhere. The evidence for ancient copper mining in Egypt is twofold, first, the existence of ancient mines with ruins of mining settlements and mining debris, and second, inscriptions in the neighbourhood of mines, left by mining expeditions. »

Lyons, Sir Henry. Two notes on land-measurement in Egypt. *Journal of Egyptian Archaeology*, 12, 242-44, 1 pl., 1926. ISIS

1. The origin of Greek geometry; 2. The groma.

Meyer, Eduard. Geschichte des Altertums. II. Band. 2. völlig neubearb. Aufl. 1. Abteilung : Die Zeit der ägyptischen Grossmacht. XIII+620 p., 8 pl. Stuttgart, COTTA, 1928. ISIS

Reviewed by JULIUS LEWY, *Deutsche Literaturzeitung*, 1, 272-75, 1930.

Nicklin, T. Studies in Egyptian chronology. Part 1 : A revised text

on MANETHO's Dynasties. 74 p. Part 2: The Sothic cycle. 24 p. London, BLACKBURN, TOULMIN, 1929. ISIS

Porter, Bertha; Moss, Rosalind L. B. Topographical bibliography of ancient Egyptian hieroglyphic texts, reliefs, and paintings. Vol. II. Theban temples. XVIII+203 p. Oxford, Clarendon Press, 1929. ISIS

Reich, Nathaniel. A grammatical exercise of an Egyptian schoolboy. *Journal of Egyptian Archaeology*, 10, 285-88, facs., 1924. ISIS

Sandford, K. S., Arkell, W. J. Prehistoric survey of Egypt and Western Asia. Vol. 1: Paleolithic man and the Nile-Faiyum Divide; a study of the region during Pliocene and Pleistocene times. XV+77 p., 11 pl. (*University of Chicago Oriental Institute Publications*, vol. 10.) Chicago, University of Chicago Press, 1930. ISIS

Simpson, D. C. The Hebrew book of proverbs and the teaching of AMENOPHIS. *Journal of Egyptian Archaeology*, 12, 232-39, 1926. ISIS

Sobhy, G. P. G. An eighteenth dynasty measure of capacity. *Journal of Egyptian Archaeology*, 10, 283-84, 1 pl., 1924. ISIS

Spence, Lewis. The mysteries of Egypt or the secret rites and traditions of the Nile. 285 p. Philadelphia, MCKAY, 1930. ISIS

Thompson, Sir Herbert. Length-measures in Ptolemaic Egypt. *Journal of Egyptian Archaeology*, 11, 151-53, 1925. ISIS

Vogel, K. Die Grundlagen der ägyptischen Arithmetik in ihrem Zusammenhang mit der 2/n-Tabelle des Papyrus Rhind. 211 p. München, BECKSTEIN, 1929. ISIS

Reviewed by EUGEN LÖFFLER, *Mitt. zur Geschichte der Medizin*, 29, 69-70, 1930.

Walle, B. van de. Les origines égyptiennes du théâtre dramatique. *Chronique d'Egypte*, 5, 37-50, 1930. ISIS

Worringer, Wilhelm. Egyptian art. Authorized translation. Edited with a preface by BERNARD RACKHAM. X+95 p., pl., ills. (Containing original illustrations.) London, PUTNAMS, 1928. ISIS

3. — BABYLONIA AND ASSYRIA

Albright, W. F. The new cuneiform vocabulary of Egyptian words. *Journal of Egyptian Archaeology*, 12, 186-90, 1926. ISIS

Archibald, R. C. Babylonian mathematics. *Science*, 71, p. 342, 1930. ISIS

Apropos of the tablet from Sennacherib's palace divided into 480 equal parts (British Museum, K 90). G. S.

Boyer, G. Contribution à l'histoire juridique de la première dynastie babylonienne. VI+86 p. Paris, GEUTHNER, 1928. (75 frs.) ISIS

« Les tablettes, qui sont l'objet de la présente publication, font partie de la collection de l'École des Hautes-Études (section des Sciences historiques et philologiques) et ont été acquises, par les soins du P. V. SCHEIL, avant 1914. Pour assurer à ce recueil une plus grande unité, j'ai cru devoir borner mon choix à un certain nombre de textes de même époque, de même provenance et se rapportant tous, à des titres divers, à l'histoire des institutions juridiques. Les textes contenus dans ce volume remontent tous à la première dynastie babylonienne (XX^e^ et XXI^e^ siècles avant notre ère). La plupart sont datés des règnes d'HAMMOURABI et de son successeur SAMSUILUNA. Ils sont tous originaires de la Mésopotamie méridionale, de la ville de Larsa et de la région environnante. »

British Museum. The Babylonian story of the deluge and the epic of Gilgamish. With an account of the Royal Libraries of Nineveh. 57 p. London, British Museum, 1930. ISIS

Cuq, Edouard. Études sur le droit babylonien. Les lois assyriennes et les lois hittites. VII+522 p. Paris, GEUTHNER, 1929 (150 frs.). ISIS

Introduction; 1. Le mariage d'après les lois de ḪAMMURABI; 2. L'adoption; 3. L'affranchissement; 4. Les successions; 5. Les donations; 6. La propriété foncière; 7. L'exploitation du domaine royal; 8. Les contrats; 9. Les nouveaux fragments du Code; 10. Les sociétés; 11. Le cautionnement; 12. Le gage; 13. Essai sur l'organisation judiciaire de la Chaldée; 14. Les contrats de Kerkouk au Musée Britannique et au Musée de l'Irak; 15. Les lois assyriennes; 16. Les lois hittites.

« Les actes juridiques des pays de Sumer et d'Accad, les tablettes Cappadociennes, les lois de ḪAMMURABI et les actes de la I^re^ dynastie de Babylone sont les plus anciens monuments que l'on possède sur le droit. De beaucoup antérieurs aux Codes brahmaniques et à la loi mosaïque, ils contiennent des traces nombreuses des institutions primitives, celles qu'on observe à l'origine de toutes les civilisations. Mais, en Babylonie, deux mille ans avant notre ère, ces institutions ne sont guère que des survivances : l'évolution a commencé. La population devenue sédentaire est adonnée à l'agriculture, au commerce et à l'industrie. La propriété de tribu s'est transformée en propriété privée; l'achat de la femme n'est plus une condition essentielle du mariage; la vengeance du sang a fait place, soit à des compositions en

nature, soit à des compositions pécuniaires, calculées d'après un tarif fixé par la loi; la juridiction civile s'est substituée à celle qui s'exerçait dans les temples sous l'inspiration des dieux. Au temps de HAMMURABI, le droit babylonien donne l'impression d'une législation déjà avancée : le sentiment de l'équité y a pénétré profondément. La protection du faible contre le puissant se manifeste dans les rapports du patron et de l'ouvrier : engagé au mois, l'ouvrier a droit à trois jours de repos; engagé à l'année, il a droit à dix jours de congé. Trois siècles plus tard, lorsque la Babylonie a été conquise par un peuple encore barbare, par les Kassites, une régression partielle s'est produite : les coutumes primitives reparaissent, mais les actes juridiques ont en général conservé la structure que leur avaient donnée les scribes babyloniens, et dont l'expérience avait montré les avantages. On y retrouve les clauses servant à prévenir les abus, à sauvegarder l'ordre social en assurant la stabilité des contrats et des jugements. Ce qui fait l'originalité du droit babylonien, c'est que dans les actes servant à régler les rapports d'affaires, on rencontre au début du second millénaire les premiers éléments d'une invention des juristes de Rome. Les scribes babyloniens ont imaginé une série de procédés (actes dénaturés, fictions, combinaisons de contrats) pour élargir la sphère du droit et l'adapter aux besoins du commerce. Grâce à ces procédés, ils ont pu réaliser la volonté des parties sans créer de nouvelles formes d'actes juridiques. De là, pour l'interprète moderne, des difficultés qu'il ne peut résoudre sans faire une analyse minutieuse de l'acte envisagé. Cette analyse exige la collaboration des assyriologues et des juristes : les uns pour préciser la signification littérale de l'acte, les autres pour en reconnaître la nature véritable et en déterminer la portée pratique, à l'aide des rapprochements suggérés par l'histoire comparative du droit. Les progrès accomplis depuis un quart de siècle dans l'explication des textes cunéiformes permettent aujourd'hui de traduire exactement la plupart des actes juridiques. Ces progrès sont dus, dans une large mesure, aux travaux du P. VINCENT SCHEIL. »

Ebeling, Erich; Meissner, Bruno. Reallexikon der Assyriologie. Band 1, Lieferung 3 : Arwium — Assyrien. p. 161—240, pl. 23-38, Berlin, DE GRUYTER, 1929. ISIS

Forrer, Emil. Astronomische Festlegung des SOPPILULJOMAS, MORSILIS und AMENOPHIS IV. *Forschungen* von EMIL FORRER, 2, p. 1-37, 1 fig. Berlin, 1926. ISIS

The solar eclipses visible in Boghazkeui in 1362 (March 12), 1360 (July 15), 1340 (Jan. 8, 11 a.m., total), 1335 (March 13), 1328 (Oct. 17) were discussed, by CARL SCHOCH, on p. 5 and 6; there is a sketch of the tracks of the eclipses of 1340, 1335, and 1328, signed by C. SCHOCH. A. P.

Frank, Carl. Strassburger Keilschrifttexte in sumerischer und babylonischer Sprache. 36+XX p. (*Schriften der Strassburger Wissenschaftlichen Gesellschaft in Heidelberg*, Neue Folge, 9. Heft). Berlin, DE GRUYTER, 1928. ISIS

Reviewed by A. DEIMEL in *Orientalistische Literaturzeitung*, 33, 30-32,

1930. The review is followed, p. 32-33, by « Zusätzliche Bemerkungen über die mathematischen Texte », by O. NEUGEBAUER. A. P.

Gadd, C. J. History and monuments of Ur. XV+269 p. New York, DUTTON, 1929. ISIS

Reviewed by A. T. OLMSTEAD, *American Historical Review*, 35, 649, 1930.

Koschaker, Paul. Neue Keilschriftliche Rechtsurkunden aus der el-Amarna Zeit. Leipzig, HIRZEL, 1928. ISIS

Reviewed by C. J. GADD, *Journal of the Royal Asiatic Society*, 174-75, 1930.

Rivet, Paul. Sumérien et océanien. 60 p. (Collection linguistique publiée par la Société de Linguistique de Paris, 24). Paris, CHAMPION, 1929. ISIS

Smith, Sidney; Gadd, C. J. A cuneiform vocabulary of Egyptian words. Additional note by T. ERIC PEET. *Journal of Egyptian Archaeology*, 11, 230-40, 1925. ISIS

Smith, Sidney. Early history of Assyria to 1000 B. C. XXVII+418 p. New York, DUTTON, 1929. ISIS

Reviewed by A. T. OLMSTEAD, *American Historical Review*, 35, 317-18, 1930.

Thompson, R. Campbell. The epic of Gilgamish. Text, transliteration and notes. 93 p., 59 pl. Oxford, Clarendon Press, 1930. ISIS

Thureau-Dangin, François. La chronologie des trois premières dynasties babyloniennes. *Revue d'assyriologie et d'archéologie orientale*, 24, 181-198, 1927. ISIS

The author accepts 2105 as the date of the foundation of the first dynasty. The tenth reign, that of AMMIZADUGA, is accordingly from 1857 to 1837. A. P.

Wieleitner, Heinrich. Zur Geschichte der Entdeckung des babylonischen Sexagesimalsystems. GEORG STICKER Festgabe, 11-17, Berlin, SPRINGER, 1930. ISIS

Woolley, C. Leonard. Ur of the Chaldees : a record of seven years of excavation. 210 p., 16 pl., London, BENN, 1929. ISIS

Woolley, C. Leonard. Vor 5000 Jahren. Die Ausgrabungen von Ur und die Geschichte der Sumerer. 4. Aufl. 115 p., 10 fig., 17 pl. Stuttgart, FRANCKH, 1929. ISIS

Zinner, Ernst. Die Sternkunde der Babylonier. *Die Sterne*, 217-24, Potsdam, 1925. ISIS

4. — GREECE

Bailey, Cyril. The Greek atomists and EPICURUS. VI+619 p. Oxford, Clarendon Press, 1928 (24 S.). ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 123-25, 1929.

Bögel, K. Eclogae graecolatinae, fasc. 54. Aus dem mathematischen Schrifttum der Griechen, hrsg. von K. B. 32 p., Leipzig, TEUBNER, 1930. ISIS

Courts extraits, à l'usage des classes, de PROCLUS sur l'histoire des mathématiques, de XÉNOPHON, PLATON, CICÉRON et QUINTILIEN (ces deux derniers en latin bien entendu) sur la valeur des mathématiques; de THUCYDIDE, POLYBE, PROCLUS, PAPPUS, sur le problème des isopérimètres; de PAPPUS, EUTOCHIUS, sur le « problème de Délos »; de JAMBLIQUE, EUCLIDE, NICOMAQUE, THÉON DE SMYRNE, sur les nombres entiers; D'EUCLIDE, PLATON, ARISTOTE, sur les irrationnels. L. G.

Brock, Arthur J. Greek medicine. Being extracts illustrative of medical writers from HIPPOCRATES to GALEN, translated and annotated. VII+256 p. London, DENT, 1930. ISIS

Tannery, Paul. Pour l'histoire de la science hellène : de Thalès à Empédocle. 2e édition par A. DIÈS, avec une préface de FEDERIGO ENRIQUES. XXIV+435 p. Paris, GAUTHIER-VILLARS, 1930. ISIS

5. — ROME

Cumont, Franz. Les religions orientales dans le paganisme romain. Conférences faites au Collège de France en 1905. Quatrième édition augmentée, remaniée, illustrée et annotée. Publiée sous les auspices du Musée Guimet. XVI+339 p., 16 pl., 13 fig. Paris, GEUTHNER, 1929. ISIS

1. Rome et l'Orient, les sources; 2. Pourquoi les cultes orientaux se sont propagés; 3. L'Asie Mineure; 4. L'Egypte; 5. La Syrie; 6. La Perse; 7. L'Astrologie et la magie; 8. La transformation du paganisme; Appendice : Les mystères de Bacchus à Rome. Notes (p. 205-312); index (p. 313-332).

Leake, Chauncey D. Roman architectural hygiene. *Annals of medical history*, 11, 135-63, 7 figs., 1930. ISIS

Rickard, T. A. The mining of the Romans in Spain. *The Journal of Roman Studies*, 18, 129-43, 1928. ISIS

Sloley, R. W. The groma, an ancient surveying instrument. 3 p., 3 fig. *Ancient Egypt*, Sept. 1926. ISIS

Another paper on the same subject by the same author was mentioned in *Isis*, 9, 550. G. S.

Stone, Edward Noble. Roman surveying instruments. (*University of Washington Publications in Language and Literature*, vol. 4, p. 215-42, August 1928). Seattle, University of Washington Press, 1928. ISIS

Brief descriptions, based on Greek and Latin texts and illustrated with graphic sketches, of sun dials and gnomons used for determining the true meridian, of instruments for making linear measurements (including a hodometer, which « in principle,... closely resembled a modern odometer, cyclometer, or taximeter »), of instruments for measuring or laying off horizontal and vertical angles (groma, dioptra, lychnia), and of leveling instruments. J. K. W.

Viollier, D. Géographie historique et administrative de la Suisse à l'époque romaine. *Mitteilungen der Geographisch-Ethnographischen Gesellschaft*, 25, 23-61, Zürich, 1926. ISIS

The author aims to « grouper et commenter tous les textes des auteurs anciens grecs et romains — se rapportant à la géographie de notre pays. » He points out that modern students have often fallen into error by attempting to interpret ancient texts on the basis of modern maps. Accordingly he uses the reconstructed maps of PTOLEMY as the foundation for his discussion of STRABO and other classical writers, arguing that « le texte des livres géographiques (of PTOLEMY) n'est donc que la traduction verbale de la carte. » J. K. W.

II. MIDDLE AGES

6. — MIDDLE AGES *(generalities)*

Beddie, James Stuart. The ancient classics in the mediaeval libraries. *Speculum*, 3-20, 1930. ISIS

Followed by a list of library catalogues of the period 1050-1250. G. S.

Birkenmajer, Alexandre. Le rôle joué par les médecins et les naturalistes dans la réception d'ARISTOTE au XII^e^ et XIII^e^ siècles. 15 p. (Extrait de *La Pologne au VI^e^ Congrès International des Sciences Historiques*, Oslo, 1928). Varsovie, Imprimerie WSPÓLCZESNA, 1930. ISIS

« Avec ROLAND DE CRÉMONE (c. 1230) nous finirons notre aperçu de l'histoire primitive de la réception d'ARISTOTE par les savants latins du XII^e^ et XIII^e^ siècle. Lui, le premier maître de théologie parmi les Dominicains, marque, avec les trois autres théologiens que nous avons mentionnés tout-à-l'heure

(GUILLAUME D'AUXERRE, PHILIPPE DE GREVE, GUILLAUME D'AUVERGNE) le commencement d'une époque nouvelle dans l'histoire de la théologie scolastique : ce n'est qu'avec lui et ses compagnons que débute la pénétration effective de l'aristotélisme dans la synthèse théologique et philosophique du moyen âge. Mais ce processus historique a été devancé et préparé, comme nous pensons l'avoir montré, par la réception antérieure des œuvres physiques du Stagyrite chez les médecins et les naturalistes de l'époque. On pourrait presque dire que la fortune du ' nouvel Aristote ' au seuil de la haute scolastique a cherché à s'incarner dans la carrière scientifique de ROLAND DE CRÉMONE : tous les deux ont commencé par les *subtilissimae disputationes apud physicos* et tous les deux ont fini par une chaire théologique à Paris. »

Brogger, A. W. Ancient emigrants. 24 pl., 7 maps. Oxford University Press, 1930. ISIS

Dr. BROGGER attempts to reconstruct the history of the Norse settlements and migrations of the 8th and 9th centuries from the evidence of place-names and of archaeology and from a profound understanding of the social and economic conditions of life in Scandinavia.

Cooper, Sonoma. The medical school of Montpellier in the fourteenth century. *Annals of medical history*, 11, 164-95, 1930. ISIS

D'Irsay, Stephen. On the original connection between medicine and the university. WELCH Festschrift. *Bull. of the Johns Hopkins Hospital*, 46, 117-22, 1930. ISIS

Laistner, M. L. W. The mediaeval organ and a CASSIODORUS glossary among the spurious works of BEDE. *Speculum*, 5, 217-21, 1930. ISIS

Larsen, Sofus. De gamle Nordmaends og Islaenderes syn paa verdenshjornernes beliggenhed. (Summary in English). *Geografisk Tidsskrift*, 32, 66-67, 1929. ISIS

Confusion regarding direction in the mediaeval Norse and Icelandic writings may be explained partly on the ground that the compound terms northwest, northeast, etc. did not enter into current usage until a relatively late period. One passage in the Knytlinga Saga places east in the north. This idea is borrowed from Danish sources and may have originated ultimately in a misunderstanding of Roman maps on which east was placed at the top.

J. K. W.

Mitteis, Heinrich. Politische Prozesse des früheren Mittelalters in Deutschland und Frankreich. 124 p. *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, philosophisch-historische Klasse*, Jahrgang 1926-27. 3. Abhandlung, 1927. ISIS

Normann, Herbert. Disputatio PLATONIS et ARISTOTELIS. Ein apo-

krypher Dialog aus dem frühen Mittelalter. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 68-86, 1930. ISIS

This text has come down to us in three ninth century MSS. (two of them in St. Gall and one in Brussels). « Interessant an diesem Text ist nun, dass er in zwei verschiedenen Fassungen vorliegt, der ursprünglichen heidnischen Fassung, die alle 3 Handschriften enthalten und einer christlichen Fassung, die sich nur in der Brüsseler Handschrift vorfindet. Die Überlieferung ist stark verdorben, so dass die Wiederherstellung des Textes, die wir hier geben, nur als ein vorläufiger Versuch zu betrachten ist. Ich lasse zunächst den Text in den beiden Versionen folgen. » The texts (p. 68-73) are followed by a discussion concluding : « Überschaut man all diese Stellen, so ist es in keiner Weise mehr zweifelhaft, dass unser Text aus dem gleichen Kreis hervorgegangen ist, dem auch die Schriften BEDAS und der Münchener sowie der Salernitaner Codex entstammen. »

Rathgen, Bernhard (1847-1927). Das Geschütz im Mittelalter. XIX+718 p., 16 pl., quarto. Berlin, Verein deutscher Ingenieure, 1928. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 125-27, 1929.

Sigerist, Henry E. Zum Herbarius PSEUDO-APULEI. *Sudhoffs Archiv für Geschichte der Medizin*, 23, 197-204, 1930. ISIS

Apropos of SIMONINI's publication, Modena, 1929.

Simonini, Riccardo. Medicinae varia in codice dell' VIII secolo conservato nell' Archivio Capitolare della Metropolitana di Modena. APULEI Liber. V+39 p., 3 pl. Modena, Tip. Immacolata Concezione, 1929. ISIS

Discussed by HENRY E. SIGERIST in *Sudhoffs Archiv für Geschichte der Medizin*, 23, 197-204, 1930.

Stephenson, Carl. Taxation and representation in the Middle Ages. HASKINS anniversary essays in mediaeval history, p. 291-312, Boston, 1929. ISIS

Sudhoff, Karl. Currents of anatomical instruction in the Middle Ages before VESALIUS. WELCH Festschrift. *Bull. of the Johns Hopkins Hospital*, 46, 149-50, 1930. ISIS

Thorndike, Lynn. Of the cylinder called the horologe of travelers. *Isis*, 13, 51-2, 1929. ISSI

« The reference is not, as one might at first think but for the age of the manuscripts, to some time-piece after the order of the modern watch, but to a portable cylindrical form of sun dial, of which the main idea at least appears to go back to the days of HERMANN THE LAME who died in 1054. »

Thorndike, Lynn. Vatican Latin manuscripts in the history of science and medicine. *Isis* ,13, 53-93, 1929. ISIS

« This paper is the outcome of six weeks spent in the summer of 1927 in the Manuscript Study Room of the Vatican Library in the endeavor to obtain some idea of the materials there available in the Latin language, especially for the history of science. » Followed by indexes of names, subjects, MSS., incipits.

7. — BYZANTIUM

Bréhier, Louis. Notes sur l'histoire de l'enseignement supérieur à Constantiniople. *Byzantion*, 3, 73-94, 1927 ; 4, 13-28, 1929. ISIS

Rice, D. Talbot. Byzantine glazed pottery. Introduction by BERNARD RACKHAM. 6 pl., figs. Oxford University Press, 1930. ISIS

Valdenberg, Vladimir. Philosophie byzantine aux IVe-Ve siècles. *Byzantion*, 4, 237-68, 1929. ISIS

III. ORIENTAL SCIENCE AND CIVILIZATION

8. — ASIA

Western Asia.

Basmadjian, K. J. Un manuscrit de GALIEN (?) en arménien. *Bulletin de la société française d'histoire de la médecine*, 24, 41-3, 1930. SIIS

Dussaud, René. Topographie historique de la Syrie antique et médiévale. (*Service des antiquités de Syrie et du Liban. Bibliothèque archéologique et historique*, 4). LII+625 p., 16 maps. Paris, GEUTHNER, 1927. ISIS

Ouvrage tout-à-fait fondamental dont il suffit de signaler l'existence. Il débute par une histoire de la cartographie de la Syrie et une longue bibliographie. On se rappelle le livre de MAURICE GAUDEFROY-DEMOMBYNES sur la Syrie à l'époque des Mamelouks d'après les sources arabes, publié dans la même collection (1923; *Isis*, 6, 561-63). Le livre de DUSSAUD se rapporte à un sujet beaucoup plus vaste. L'identification des noms de lieux anciens et médiévaux soulève une quantité de problèmes difficiles. L'ouvrage est divisé en huit chapitres se rapportant chacun à une région déterminée; il y a treize cartes fort détaillées qui sont raccordées par un tableau d'assemblage et complètement indexées. Bref, pour toute question concernant la topographie syrienne, il faudra toujours consulter DUSSAUD. G. S.

Jerphanion, G. de (S. J.) Mélanges d'archéologie anatolienne. Monuments préhelléniques, gréco-romains, byzantins et musulmans de Pont, de Cappadoce et de Galatie. (*Mélanges de l'Université Saint-*

Joseph, Beyrouth, Liban, tome 13). 2 vols. Vol. 1 : text, 329 p., 61 figs ; vol. 2 : plates, CXX. Beyrouth, Imprimerie Catholique, 1928 (180 frs.). ISIS

These two volumes though dated 1928, do not seem to have actually appeared before 1930. They contain abundant epigraphical and other archaeological information relative to Anatolia, chiefly Angora. The text is illustrated by means of a very fine series of 120 plates.

G. S.

Central Asia

Barthold, W. Turkestan down to the Mongol invasion. Second edition, translated from the Russian and revised by the author with the assistance of H. A. R. GIBB. XX+514 p., map. *(E. J. W. Gibb Memorial Series)*. London, LUZAC, 1928. ISIS

Reviewed by PAUL PELLIOT, *T'oung pao*, 27, 12-56, 1930.

Francke, August Hermann (d. 1930). Ein Dokument aus Turfan in tibetischer Schrift, aber unbekannter Sprache. *Sitzungsber. d. Preuss. Akad. d. Wiss., phil.-hist. Kl.*, p. 124-30, 1 pl., 1927. ISIS

Francke, August Hermann (d. 1930). Königsnamen von Khotan (a-ma-ca) auf tibetischen Dokumenten der Turkistansammlungen von London und Berlin. *Sitzungsber. d. Preuss. Akad. d. Wiss., phil.-hist. Kl.*, p. 671-76, 1928. ISIS

Margerie, Emmanuel de. L'œuvre de SVEN HEDIN et l'orographie du Tibet. 139 p., 28 figs., 1 portrait. (Extrait du *Bulletin de la Section de Géographie du Comité des Travaux historiques et scientifiques*, 1928). Paris, Imprimerie Nationale, 1929. ISIS

Cette analyse détaillée de l'œuvre immense de SVEN HEDIN sur le Tibet (Stockholm 1917-22 ; *Isis*, 6, 188), est fort bienvenue, car l'œuvre elle même est presque inaccessible à la plupart des lecteurs à cause de son prix élevé (700 couronnes). La partie concernant l'histoire de la topographie de l'Asie centrale est spécialement intéressante. « En raison du grand nombre de pièces, manuscrites ou gravées, qui ont été reproduites sur les planches jointes aux volumes de *Southern Tibet*, et de la parfaite exécution de ces copies — obtenues exclusivement par des procédés photographiques —, l'ouvrage de SVEN HEDIN vient prendre rang parmi les plus importants recueils de documents consacrés à l'histoire de la Cartographie, à côté du Periplus et du Facsimile-Atlas de l'illustre A. E. NORDENSKJÖLD, sortis, d'ailleurs, il y a quarante ans, des mêmes ateliers. Ces quelque deux cents planches, réunies en Album, constitueraient une sorte de corpus des plus attrayants : il y a là des monuments de toutes provenances, depuis la mappe-monde de FRA MAURO jusqu'à des cartes dont la légende est inscrite en persan ou en chinois. » L'auteur nous donne une longue énumération de

ces documents, et reproduit plusieurs croquis qui nous permettent de juger en quelque sorte à vue d'œil du progrès de la cartographie tibétaine, le tout accompagné de nombreuses notes critiques. L'ouvrage de SVEN HEDIN contient aussi une histoire de l'exploration du Tibet qui ne couvre pas moins de 1203 pages !, sans compter 624 p. consacrées à l'histoire de la géographie chinoise, rédigées avec le concours de E. HÄNISCH, ALB. HERRMANN, et et A. v. LE COQ. Tout cela est résumé dans le présent travail (p. 51-86, 125-27), qui se termine par un excellent index. Soit dit en passant, SVEN HEDIN confirme notre bonne opinion des géographes chinois : « The Chinese topographers », écrit-il, « never enter any geographical feature upon their maps unless they have themselves actually seen it... Everybody who has had an opportunity to travel in parts of Asia which have been surveyed by Chinese explorers will have been struck by their reliability. » G. S.

Pelliot, Paul. Neuf notes sur des questions d'Asie Centrale. *T'oung pao*, 26, 201-85, 1929. ISIS

9. — INDIA

Adams, Frank Dawson. The geology of Ceylon. *Canadian Journal of Research*, 1, 425-511, 8 pl., 2 figs., map., 1929. ISIS

« The paper presents the first account which has been given of the geological structure of the island, and the accompanying geological map of the island is the first which has been prepared. »

Âpastamba. Das Srautasûtra des ÂPASTAMBA. Sechszehntes bis vierundzwanzigstes und einunddreissigstes Buch. Aus dem Sanskrit überstezt von W. CALAND. 459+1+1 p. (*Verhandelingen der Koninklijke Akademie van Wetenschappen te Amsterdam*, Afd. Letterkunde, Nieuwe Reeks, D. XXVI, no. 4). Amsterdam, 1928. ISIS

Reviewed by L. D. BARNETT, *Journal of the Royal Asiatic Society*, 446-47, 1930.

Balfour, Margaret I. ; Young, Ruth. The work of medical women in India. Foreword by Dame MARY SCHARLIEB. XV+201 p. Oxford University Press, 1930. ISIS

Blochet, E. Les sources grecques et chrétiennes de l'astronomie hindoue. Notes additionelles. *Revue de l'Orient Chrétien*, 5, p. 400 sq., 6, 32-73, 1927-28. ISIS

Chanda, Ramaprasad. Survival of the prehistoric civilisation of the Indus Valley. 40 p., 2 pl. (*Memoirs of the Archaeological Survey of India*, no. 41). Calcutta, Government of India, Central Publication Branch, 1929. ISIS

« The relics of the prehistoric period discovered at Mohenjo-daro and

Harappa leave no room for doubt that the Chalcolithic civilisation of the Indus Valley was something quite different frop the Vedic civilisation. The question that now demands our attention is, what became of this great civilisation and what became of its authors when the Aryan immigrants who offered sacrifices to the Devas and cremated their dead occupied the land? Did the Aryan invaders sweep away the pre-Aryan civilisation of the Indus Valley like the Dorian invaders of Greece, or did they, like the earlier Aryan invaders of Greece, the Achaeans, establish themselves as a powerful minority among the native populations, and the contact of the Aryan and pre-Aryan cultures resulted in the birth of the mixed Hindu civilisation? » Contents : Ārya and Dāsa; Priest and king; Human sacrifice; Anumarana; The Vrâtya and the Yati; The tree and the animal standard; Index.

Clark, Walter Eugene. Hindu-Arabic numerals. Indian Studies in honor of CHARLES ROCKWELL LANMAN, 217-36, Cambridge. 1929. ISIS

Supporting the traditional opinion, which ascribes these numerals to the Hindus, against the late G. R. KAYE. « During the past few years KAYE has written a series of articles in which he disputes this general opinion with greater and greater vehemence and certainty. He claims that he is the first one to apply a strictly scientific method to this particular problem. His method consists in denying all validity to Indian literary tradition and to Indian manuscripts previous to the date at which the manuscripts themselves were written. The only admissible evidence is that of inscriptions and coins. On this basis he tries to prove that the numerical symbols with zero and place value were unknown in India until the end of the ninth century A. D., and that Indians and Arabs alike must have taken them from some third source. Having reached this fundamental position he makes use of Indian literary tradition only in so far as it does not contradict his scientific conclusion. All passages which are definitely in contradiction with this conclusion are later interpolations. The Arabic literary evidence is handled in the same way. All passages which suggest an Indian origin or praise Indian accomplishment in any branch of knowledge are legendary. Such passages as criticize the Indians and belittle their knowledge or methods are accepted as just and reasonable. On the other hand, it is very noteworthy that KAYE fails entirely to apply this same hypercritical method to Greek, Latin, and Chinese literary evidence. This is accepted as valid without criticism and without the support of inscriptions. »

Coomaraswamy, Ananda K. Geschichte der indischen und indochinesischen Kunst. Übersetzt von HERMANN GÖTZ. XI+324 p., 128 pl. Leipzig, HIERSEMANN, 1927. ISIS

Reviewed by P. PELLIOT, *T'oung pao*, 26, 379-88, 1929.

Datta, Bibhutibhusan. The Hindu contributions to mathematics. 62 p. *Bulletin of the Mathematical Association*, University of Allahabad, vol. 1 & 2, 1927-29. ISIS

DATTA's indefatigable activity ought to be well known to our readers,

for much space has already been devoted to it in *Isis*; see, e.g., vol. 13, 505-508. The present collection of articles is a very elaborate account of Hindu mathematics, expressing the extreme Hindu point of view. It is divided into five chapters : 1. Geometry; 2. Trigonometry; 3. Arithmetic; 4. Algebra; 5. Calculus. Appendix : Hindu influence on foreign matheamtics. Sanskrit quotations are occasionally printed in the footnotes. G. S.

Datta, Bibhutibhusan. The scope and development of the Hindu Gaṇita. *Indian Historical Quarterly*, 5, 479-512, 1929. ISIS

This is in fact a sketch of the development of Hindu mathematics, special emphasis being laid on the question whether that development was original or influenced by Greek examples. The author claims among other things that EUCLID's Elements were not known in India until a very late time, and that at the beginning they were known only in Muslim circles. AL-BÎRÛNÎ had planned to translate them into Sanskrit together with the Almagest, but that project does not seem to have materialized. ABU FAZL, the author of the Persian work, 'Ain-i-Akbari (c. 1590), was well acquainted with the Elements. « The earliest trace of their influence in a Sanskrit work that I have as yet seen is the Siddhântatattva-viveka of KAMALÂKARA the court-astronomer of the Emperor JAHANGIR of Delhi. It is a voluminous treatise on astronomy written in 1658 A.C. In it there are passages which are evidently copied from the Elements. » The author concludes that Hindu mathematics (as opposed to Hindu astronomy) was entirely independent of Greek mathematics; it is certain that it was as different from the Greek as it was possible to be. G. S.

Kern Institute, Leyden. Annual bibliography of Indian archaeology for the year 1928. Published with the aid of the Government of Netherlands India and with the support of the Imperial Government of India. XI+141 p., 12 pl., 11 figs. Leyden, BRILL, 1930. ISIS

Third volume of this admirable bibliography, the second volume of which was reviewed in *Isis*, 13, 512. The bibliography proper is preceded as usual by elaborate accounts of the archaeological expeditions (p. 1-30), with splendid illustrations. G. S.

Kumâra Ganaka. The Ranadîpikâ of KUMÂRA GANAKA. Edited by K. SÂMBASIVA SÂSTRÎ. 6+25 p. (*Trivandrum Sanskrit series*, no. 95) Trivandrum, Government Press, 1928. ISIS

Reviewed by L. D. BARNETT, *Journal of the Royal Asiatic Society*, 445-46, 1930. « The Rana-dîpikâ is a little manual of the art of war from the astrologer's standpoint, which in not very correct Sanskrit retails recipes whereby the ganaka may guide an ambitious monarch to victory by due observance of the rules concerning the lucky positions of the heavenly bodies, the significance of omens and portents, the preparation of magic diagrams, the knowledge of the mystic powers of the vowels, the observation of fortunate times, and other germane mysteries, the whole being preceded by a chapter on polity, based on familiar nîti-sâstras. As the book is quoted in the Prasnamârga, it is earlier than A.D. 1650; but its exact date is dubious. »

Lanman, Charles Rockwell. Indian studies. In honor of CHARLES ROCKWELL LANMAN. x+258 p. Cambridge, Harvard University Press, 1929. ISIS

A few of the studies contained in this Festschrift are mentioned in the present bibliography under India and Vth century (second half). The absence of preface, portrait, bibliography and index are not to the (unnamed) editor's credit. G. S.

Matangamuni. The Brhaddesî of MATANGAMUNI. Edited by K. SÂMBASIVA SÂSTRÎ. (*Trivandrum Sanskrit series*, no. 94). 6+155 p. Trivandrum, Government Press, 1928. ISIS

Reviewed by L. D. BARNETT, *Journal of the Royal Asiatic Society*, 445-46, 1930. « The Brhad-dêsî, or 'great treatise on sound' is a manual of music ascribed to a probably mythical MATANGA MUNI, and has some value, especially as it borrows freely from ancient sources; but it is incomplete, breaking off abruptly at the end of the sixth chapter with an unfulfilled promise to discuss the subject of vâdya-nirnaya. »

Müller, Reinhold F. G. Über Krankenhäuser aus Indiens älteren Zeiten. *Archiv für Geschichte der Medizin*, 23, 135-51, 1930. ISIS

Przyluski, Jean. Le concile de Râjagrha: Introduction à l'histoire des canons et des sectes bouddhiques. VI+434 p. Paris, GEUTHNER, 1926-8. ISIS

Reviewed by E. H. JOHNSTON, *Journal of the Royal Asiatic Society*, 421-23, 1930; by MASSON-OURSEL, *Revue de l'histoire des religions*, 99, 99-100, 1929.

Rangacharya, V. The geographical data of the Sangam works. *The Madras Geographical Association*, 3, 43-81, n.d., map. ISIS

An attempt to interpret the geographical data in the Sangam literature of southern India (circa 300 B.C.—300 A.D.). J. K. W.

Sâstrî, K. Sâmbasiva. The Rasopaniṣat. 3+4+211+20 p. (*Trivandrum Sanskrit series*, no. 92). Trivandrum, Government Press, 1928. ISIS

Reviewed by L. D. BARNETT, *Journal of the Royal Asiatic Society*, 445-46, 1930. « The Rasôpaniṣad is a medical treatise of eighteen chapters, which instructs the native practitioner in the preparation and application of the various recipes compounded of mercury, and the like. »

Senart, Emile (1847-1928). Caste in India. The facts and the system. Translated by E. DENISON ROSS. London, METHUEN, 1930. ISIS

The original French text (Les castes dans l'Inde, les faits et le système) was reviewed in *Isis*, 11, 505.

Srinivasachari, C. S. Notes on the maps of old Madras preserved

in the Madras record office. *Journal of the Madras Geographical Association*, 3, 83-106, 11 pl., 1928. ISIS

Reproductions and commentary on a series of maps and plans dating from 1673 to 1822. J. K. W.

Yazdani, G. Ajanta. Explanatory text by G. YAZDANI. Introductory essay by LAURENCE BINYON. 4 parts, 40 pl. Oxford University Press, 1930. ISIS

10. — CHINA

Forke, Alfred. Geschichte der alten chinesischen Philosophie. XVI+ 594 p. (*Hamburg, Universität, Abhandl. aus dem Gebiet der Auslandskunde*, vol. 25 ; Reihe B., Völkerkunde, Kulturgeschichte und Sprachen, vol. 14). Hamburg, FRIEDERICHSEN, 1927. ISIS

Reviewed by PAUL PELLIOT, *T'oung pao*, 27, 91-106, 1930.

Maspero, Henri. L'astronomie chinoise avant les HAN. *T'oung pao*, 26, 267-365, 1929. ISIS

« L'Astronomie chinoise a été souvent étudiée, depuis le temps où le Père GAUBIL fit connaître les grands traits de son histoire. La période antique en particulier a été l'objet de nombreux travaux : J. B. BIOT, SCHLEGEL, L. DE SAUSSURE lui ont consacré de gros ouvrages, CHALMERS un article bref, mais important. Mais tous les savants qui s'en sont occupés, quelles que fussent leurs idées, ont généralement préféré demander au calcul mathématique ou à des spéculations abstraites plutôt qu'aux textes mêmes les éléments nécessaires à l'élaboration de leurs théories. Or on pourrait tirer des textes beaucoup plus qu'il n'a été fait jusqu'ici, sinon pour la haute antiquité, où ils sont peu nombreux, au moins pour les temps plus récents de la fin de la dynastie TCHEOU. J. B. BIOT, et plus récemment SAUSSURE, M. HACHIMOTO, M. SHINJÔ SHINZÔ, se sont bien rendu compte que certains faits rapportés seulement à l'époque des HAN devaient avoir été connus longtemps avant : par exemple, la détermination du solstice d'hiver, ou la révolution synodique de Jupiter, ou encore la création des premiers calendriers astronomiques et mathématiques. On savait d'ailleurs par le *Che ki* qu'il y avait eu des astrologues célèbres dans les derniers siècles des TCHEOU ; bien plus, des fragments de leurs œuvres sont souvent cités par SSEU-MA TS'IEN. Il est étonnant que, malgré cela, personne n'ait cherché à rassembler ce qui subsiste de leurs ouvrages et à en tirer un aperçu des connaissances astronomiques antérieures aux HAN. SAUSSURE, dans ses intéressantes recherches sur l'Astronomie chinoise antique, descend parfois jusqu'à cette époque, bien qu'en général il s'occupe de périodes bien plus anciennes ; mais il n'a jamais pensé à recourir à des textes nouveaux et s'est contenté de demander au calcul de compléter ce qu'il était possible de tirer des faits qu'il avait trouvés dans GAUBIL et CHAVANNES. Aussi l'histoire de l'astronomie pendant les siècles qui précèdent immédiatement les HAN reste-t-elle très vague. » Le mémoire étendu de H. MASPERO s'efforce de combler cette lacune ; il est basé presque exclusivement sur les textes chinois, dont de nombreux

fragments sont cités. C'est une contribution très importante à l'histoire de l'astronomie. G. S.

Vissière, A. Ouvrages chinois pour l'étude de l'Arabe. *Revue des études islamiques*, 455-56, 1929. ISIS

11. — JAPAN

Mikami, Yoshio. On the establishment of the yenri theory in the old Japanese mathematics. *Proceedings of the Physico-Mathematical Society of Japan*, 12, 43-63, 1930. ISIS

Elaborate memoir intending to prove the author's old contention that the yenri or circle-principle should not be ascribed to SEKI KOWA as is generally done, notably by T. HAYASHI. G. S.

Nachod, Oskar. Bibliographie von Japan, 1906-1926. 2 vols. XVI+ 832 p. Leipzig, HIERSEMANN, 1928. ISIS

Reviewed by P. PELLIOT, *T'oung pao*, 26, 389-91, 1929.

12. — ISRAEL

Felsenthal, S. Jüdische Ärzte in Alt-Mannheim. *Archiv für Geschichte der Medizin*, 23, 184-96, 1930. ISIS

Gardiner, Alan H. The geography of the Exodus : an answer to Professor NAVILLE and others. *Journal of Egyptian Archaeology*, 10, 87-96, 1924. ISIS

Graumann, H. Erzveredelung und Schmiedekunst im alten Israel. *Beiträge zur Geschichte der Technik und Industrie*, 19, 173, Berlin, 1929. ISIS

Marx, Alexander. The polemical manuscripts in the library of the Jewish Theological Seminary of America. With appendices on the Eben Bohan and on the earlier Hebrew translations of MATTHEW. A. S. FREIDUS Memorial volume, 247-78, New York, 1929. ISIS

List of 72 MSS. with a brief description and analysis of each, followed by four appendices : 1. The different versions of IBN SHAPRUT's Eben Bohan (1385) ; 2. Jewish translations of MATTHEW into Hebrew ; 3. An astrological fragment by ABRAHAM ZACUTO; 4. Two parodies on Yigdal. G. S.

Naville, Edouard. The geography of the Exodus. *Journal of Egyptian Archaeology*, 10, 18-39, 1924. ISIS

Passarge, Siegfried. Das Judentum als landschaftskundlich-ethno-

logisches Problem. 460 p., 153 fig. München, LEHMANN, 1929.
ISIS

Reviewed by KURT GALLING, *Deutsche Literaturzeitung*, 1, 608-14, 1930.

Williams, Joseph J. (S. J.). Hebrewisms of West Africa. From Nile to Niger with the Jews. 443 p., 2 ills., 5 maps. New York, LONGMANS, 1930. ($ 7.50). ISIS

The thesis of this book is (p. 319) : « Somewhere in the dim past, a wave, or more probably a series of waves, of Hebraic influence swept over Negro Africa, leaving unmistakable traces among the various tribes, where they have endured even to the present day. » The author is extremely learned and though he does not prove his thesis completely—this could hardly be done—he comes very near to proving it. He began his study in Jamaica, whose unusual negro population he had occasion to observe during five years; then followed eleven years of intense research which carried him along all the intricate by-ways of African and Jewish lore. A number of moot questions (the « Lost tribes », ELDAD BEN MAHLI THE DANITE, etc.) are discussed carefully and with moderation. My only criticism is that the argument does not always proceed as directly as one would wish, because of the author's fondness for digression and his lack of courage in rejecting worthless evidence (he even reproduces somewhere an anonymous newspaper editorial !). One of the most interesting items is the use by the Ashanti of a breastplate which reminds one of that of the High Priest; though as he himself remarks this may possibly be traced to early Egyptian influences. With regard to linguistic similarities, many of the so-called Hebrewisms may be more simply Arabisms (e.g., the use of the word amen). At any rate, the author is very fair : he does not hesitate to mention facts which weaken his argument as well as others. The book is so rich that I shall not attempt to analyze it; it will repay study or consultation. There are abundant bibliographic notes and excellent indices. G. S.

14. — ISLAM

Basset, René (1855-1924). Mélanges RENÉ BASSET. *Etudes nord-africaines et orientales publiées par l'Institut des hautes études marocaines.* Publications de cet Institut, tomes X et XI, Paris, E. LEROUX, 1923-25.
ISIS

Contient une bibliographie des travaux scientifiques de R. BASSET (vol. 2, 463-503). Les articles de ces Mélanges concernant nos études sont mentionnés dans la présente bibliographie. G. S.

Blochet, E. Musulman painting, XIIth-XVIIth century. Translated from the French by CICELY M. BINYON. With an introduction by Sir E. DENISON ROSS. XI+124 p., 200 pl. London, METHUEN, 1930. ISIS

Berchem, Max van. Matériaux pour un corpus inscriptionum arabi-

carum. Deuxième partie, Syrie du Sud. Tome deuxième: Jérusalem, Ḥaram. Deuxième fascicule. p. 217-466. *Mémoires publiés par les membres de l'Institut français du Caire*, tome 44, 1927. ISIS

Reviewed by A. R. GUEST, *Journal of the Royal Asiatic Society*, 134-40, 1930.

Farmer, Henry George. Greek theorists of music in Arabic translation. *Isis*, 13, 325-33, 1930. ISIS

« It is worthy of notice that whilst Western Europe of the Middle Ages was almost entirely ignorant of the works of the Greek musical theorists (save what could be gleaned from MARTIANUS CAPELLA, BOËTHIUS, CASSIODORUS, & ISIDORE OF SEVILLE), the Arabs were conversant with the treatises of ARISTOXENUS, ARISTOTLE, EUCLID, NICOMACHUS and PTOLEMY. The information that has been preserved in Arabic works concerning the above Greek writers enables us to throw fresh light on some of their works. Further, it is highly probable that when the works of the Arab theorists who borrowed considerably from the Greeks, have been edited with a substantial apparatus criticus, many a debatable word or passage in the Greek treatises may be cleared up. To deal with this question within the limits of a short paper it is perhaps best that it should be approached under two headings, (a) the Greek theorists, and (b) the Arab theorists ».

Farmer, Henry George. A history of Arabian music to the XIIIth century. XV+264 p., 3 pl. London, LUZAC, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 375-6, 1930.

Ferrand, Gabriel. Introduction à l'astronomie nautique arabe (*Bibliothèque des géographes arabes*, vol. 1). XII+272 p., 25 fig. Paris, GEUTHNER, 1928 (100 frs.) ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 127-28, 1929.

Gauthier, Léon. L'argument de l'âne de Buridan et les philosophes arabes. Mélanges RENÉ BASSET, vol. 1, p. 209-33, Paris, 1923. ISIS

« En résumé : Transformation progressive des deux contraires équivalents de l'exemple aristotélicien en deux semblables parfaitement identiques; maintien de l'homme comme agent dans les divers exemples successivement proposés, et application des conclusions obtenues à la volonté divine, en vue de résoudre le problème de l'éternité du monde, tandis que les philosophes chrétiens, s'égarant à la suite de DANTE et de BURIDAN, en arrivent à substituer définitivement à l'homme un animal et énervent ainsi l'argument; invention de nouveaux exemples : les deux coupes et les deux dattes, puis le pain, qui ont pour effet de présenter le raisonnement sous une forme de plus en plus rigoureuse; compréhension très nette, de la part d'IBN ROCHD et des derniers falâcifa, du caractère artificiel de la question ainsi posée, question qui ' dans le fond est sur l'impossible ', comme dira plus tard LEIBNIZ, ou comme nous dirions aujourd'hui, n'est qu'un pseudo-problème; toutes ces attitudes et démarches des penseurs de l'Islâm, qui marquent leur intervention dans

l'élaboration progressive du célèbre argument, sont d'une heureuse inspiration et font honneur à leur esprit philosophique. »

Heller, Bernard. Récits et personnages bibliques dans la légende Mahométane. *Revue des études juives*, 85, 113-36, 1928. ISIS

D'après le récent volume de RENÉ BASSET, Mille et un contes, récits et légendes arabes. Tome 3. Légendes religieuses. 629 p. Paris, MAISONNEUVE, 1927.

Horten, M. Das philosophische System von SCHIRÂZI († 1640). Übersetzt und erläutert. XII+303 p. (*Studien zur Geschichte und Kultur des islamischen Orients*, Zwanglose Beihefte zu der Zeitschrift *Der Islam*.) Strassburg, TRÜBNER, 1913. ISIS

Jansky, Herbert. Das Meer in Geschichte und Kultur des Islams. *Beiträge zur historischen Geographie, Kulturgeographie, Ethnographie und Kartographie*, vornehmlich des Orients, hrsg. von HANS MZIK, p. 41-59, Leipzig, DEUTICKE, 1929. ISIS

Krachkovski, I. J. Shaikh ṬANṬĀWĪ (1810-1861), Professor at the University of St. Petersburg. *Publications of the History of Knowledge Commission*, No. 8. II+134 p., fig., facsim., portr. Leningrad, Academy of Sciences, 1929. (In Russian). ISIS

This is the bio-bibliography of AL-ṬANṬĀWĪ promised by IGN. KRACHKOVSKI in his short article—written, 1925; published, 1929—in the *Encyclopaedia of Islām*, IV, 655 (*Enzyklopädie des Islām*, IV, 709-10). MUḤAMMAD 'AIYĀD AL-ṬANṬĀWĪ was born in 1225 (1810) at Nijrīd, near Ṭanṭā, Egypt, and died in 1861 in St. Petersburg; he came to that city in 1840, and became professor of Arabic in the University in 1847. Most of the Russian and European papers on AL-ṬANṬĀWĪ are very inaccurate and incomplete; more valuable bio-bibliographical material appeared, in Arabic, in *La Revue de l'Académie Arabe*, IV, Damascus, 1924, and in *al-Zahrā*, I, Cairo, 1343 (1924-25). The present monograph, based on results of research begun in 1916, is a practically perfect piece of work. The Introduction (p. 1-9) points out the sources of information and misinformation, and indicates the path followed by the author. Chapter I (p. 10-35) is devoted to the Egyptian, Chapter II (p. 36-58) to the Russian period of the life of AL-ṬANṬĀWĪ. Chapter III (p. 59-85) is a classified and critical bibliography of his published and unpublished works (41 items). The short autobiography of AL-ṬANṬĀWĪ, based both on the Kosegarten edition (1850) and on the MS in the University Library, constitutes Appendix A (p. 89-93). Appendix B (p. 94-117) is a descriptive catalogue of biographically valuable material (47 items) selected from the AL-ṬANṬĀWĪ collection of MSS in the University Library. Four carefully compiled Indexes (p. 121-134) complete the volume : I. Names of persons; II. Authors and works quoted; III. Works of AL-ṬANṬĀWĪ (with a synoptic table to Chapter III); IV. Arabic MSS quoted (with a list arranged by libraries and a synoptic table to Appen-

dix B) ; the difficulties arising from the heterogeneity of the material—Arabic, Russian, and European names and titles; Arabic words in Russian transcription; anonymous works; abbreviated titles, etc.—have been solved quite satisfactorily. The printer has paid as much attention as the author to the most insignificant details, and the result is a welcome addition to the *Publications of the History of Knowledge Commission* (see *Isis*, 15, 311).
A. P.

Lammens, Henri (S.). L'Islam. Manuale delle credenze ed istituzione musulmane. Traduzione e appendice di RUGGIERO RUGGIERI. XIX+278 p. Bari, 1929. ISIS

Original French text published in 1926 (*Isis*, 10, 248). There is also an English translation by Sir E. DENISON ROSS, 1929 (*Isis*, 13, 527).

Newcomb, Rexford. The decorative tiles of North Africa. 32 p., 16 figs. (*Architectural monographs on tiles and tilework*, no. 7). New York, Associated Tile Manufacturers, 1929. ISIS

Râghib aṭ-Ṭabbâkh, Muḥammad. Kitâb al-firâsa li-Filîmûn, followed by Jumal aḥkâm al-firâsa, by ABÛ BAKR MUḤAMMAD B. ZAKARÎYÂ AR-RÂZÎ. Edited by MUḤAMMAD RÂGHIB AṬ-ṬABBÂKH. 57 p. Halab, 1347 (1929). ISIS

Reviewed by F. KRENKOW, *Journal of the Royal Asiatic Society*, 483, 1930. Two treatises on physionomy. The first is a translation of the Greek one by POLEMON OF LAODICEA (first half of the second century), for which see my *Introduction* (vol. 1, 271). The second was written by AL-RÂZÎ.
G. S.

Robertson, Edward. Arab weather prognostics. *Journal of the Royal Asiatic Society*, 377-89, 1930. ISIS

« The majority of Arab weather prognostics are, as might be expected, concerned with the winter season, when the changeable weather gives scope for forecasting. The summer months in most Arabic-speaking lands are rainless, and except for wind changes offer little or no field for the activity of the weather prognosticator. The sun and moon, the stars, the rainbow, mist, dew, thunder and lightning, birds and insects all form constituents in Arabic weather forecasts. »

Ruska, Julius. Die Vision des Arisleus. GEORG STICKER Festgabe, 22-26, Berlin, SPRINGER, 1930. ISIS

« Die ' Visio Arislei ' gehört zu dem Schriftenkreis, der sich an die ' Turba Philosophorum ' anschliesst. Sie ist in verschiedenen alten Sammlungen alchemistischer Werke gedruckt und erfreut sich wie die Turba selbst keines guten Leumunds. Das ist weiter nicht verwunderlich, da man ebenso durch den Rattenkönig von unverständlichen Namen, mit dem der gedruckte Text beginnt, wie durch die Unverständlichkeit der Allegorie selbst, die den Hauptinhalt bildet, von einer näheren Beschäftigung mit der Schrift

abgeschreckt wird. » « In der Allegorie wird unter dem Bild einer Zeugung ein chemischer Vorgang beschrieben. Der König der Meerbewohner hat einen Sohn Cabritis (Chambritis, Cambertius, Thabritis usw.) und eine Tochter Beua (Buna, Beya), die Arisleus miteinander vereinigt. Die Namen bedeuten Schwefel und Quecksilber. Der Name Cabritis ist nur eine leichte Veränderung des arabischen kibrit, Schwefel. Der Name der Schwester, die als ' puella candida ' beschrieben wird, war etwas schwerer zu ermitteln, da das Quecksilber durch einen Decknamen bezeichnet ist. Es muss Beida, d.i. arabisch (al)baiḍā, die Weisse, gelesen werden. Ich gebe im nachfolgenden eine Übersetzung des Textes der Berliner Handschrift mit den notwendigsten Erläuterungen. Für den lateinischen Text und alles Weitere verweise ich auf meine demnächst erscheinenden Untersuchungen zur Geschichte der ' Turba '. »

Sotheran, Henry. Arabistan : a catalogue of various editions of the Arabian Nights, and cognate works, books on the countries and peoples of the Nights. An extensive collection of books by Sir RICHARD and LADY BURTON, etc. Catalogue no. 818. London, SOTHERAN, 1930. ISIS

Wetzstein, Johann Gottfried (1815-1905). Die Königslose. J. G. WETZSTEINS freie Nachdichtung eines arabischen Losbuches. Überarbeitet und eingeleitet von GOTTHOLD WEIL. 70 p. Berlin, DE GRUYTER, 1929. ISIS

Reviewed by E. LITTMANN, *Deutsche Literaturzeitung*, 1, 12-15, 1930.

PART III

SYSTEMATIC CLASSIFICATION

Including only the material which could not be included in Parts I and II. Hence studies on Japanese astronomy or on XIIth century astronomy are not classified below under astronomy, but above, respectively under Japan (in Part II) and XIIth Century (in Part I).

The sections forming Part III are classified as follows :

I. *Science in general* : 15. Bibliography; 16. History; 17. Organization; 18. Philosophy.

II. *Formal sciences* (Knowledge of forms) : 19. Logic and Theory of Knowledge; 20. Mathematics; 21. Statistical methods.

III. *Physical sciences* (Knowledge of inorganic nature) : 22. Mechanics; 23. Astronomy; 24. Physics; 25. Chemistry (Physico-chemistry, Industrial chemistry); 26. Technology.

IV. *Biological sciences* (Knowledge of organic nature) : 27. Biology (Generalities, « Natural history »); 28. Botany (Agronomy, Phytopathology, Palaeobotany); 29. Zoology.

V. *Sciences of the earth* (implying knowledge of both organic and inorganic nature) : 30. Geodesy; 31. Geography and Oceanography; 32.

Geology, Mineralogy, Palaeontology, Mining; 33. Meteorology, Climatology and Terrestrial Physics.

VI. *Anthropological and historical sciences* (Knowledge of man, past and present): 34. Anatomy; 35. Physical anthropology (anthropometry and races of man); 36. Physiology (human and comparative); 37. Psychology (human and comparative); 38. Archaeology (generalities, methods); 39. Prehistory; 40. Ethnology (primitive and popular science); 41. Superstition and Occultism.

42. Economics (economic doctrines and history; commerce; transportation and communications); 43. Sociology, Jurisprudence and Positive polity; 44. History of civilization (general history, historical methods, biography and chronology); 45. History of art (Art and science; Iconography; Arts and crafts); 46. History of language, writing and literature; 47. History of morals (Moral organization of society); 48. History of philosophy; 49. History of religion (Science and religion).

VII. *Medicine*: 50. History, organization and philosophy of medicine; 51. Epidemiology, History of special diseases. Public health and Social medicine; 52. History of hospitals and of medical teaching; 53. Pharmacy; Pharmacology; Toxicology.

VIII. *Education* (the methods of accumulating, imparting and diffusing knowledge); 54. Education (Generalities, Methods, Colleges, Universities); 55. Academies, Societies, Congresses, National and international organization of science; 56. Bibliography. (Methods, Libraries); 57. Museology (Museums and Collections).

IX. 58. Alia; 59. Errata.

The applied sciences are not disconnected from the pure sciences, but, as far as possible, the principles and applications of science are considered in the same section. However, applications based upon the principles of many sciences are dealt with separately (ex. technology; medicine; education).

I. SCIENCE IN GENERAL

16. — HISTORY OF SCIENCE

Barnes, Harry Elmer. The history of science: Teaching and personalia. *Isis*, 13, 356-8, 1930. ISIS

1. New York City. American Society of Medical History; 2. The American Association of the History of Medicine; 3. The International Association of the History of Medicine; 4. University of California; 5. New York University; 6. University of Michigan; 7. Carnegie Institution; 8. L. GUINET.

Meisel, Max. A bibliography of American natural history. The Pioneer century, 1769-1865. The role played by the scientific societies; scientific journals; natural history museums and botanic gardens; state geological and natural history surveys; federal exploring expeditions in the rise and progress of American botany,

geology, mineralogy, palaeontology and zoology. Volume III. The institutions founded or organized between 1845 and 1865. Bibliography of books. Chronological tables. Index of authors and institutions. Addenda to volume 1, XII+749 p. Brooklyn, New York, The Premier Publishing Co., 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 376-78, 1930.

Picard, Emile. Un coup d'œil sur l'histoire des sciences et des théories physiques. 101 p. Paris, GAUTHIER-VILLARS, 1930. ISIS

Also printed, at least in part, in the *Revue scientifique*, 1930.

Sarton, George. Medallic illustrations of the history of science. (First series : XIXth and XXth centuries). Seventh article. *Isis*, 13, 353-55, 4 pl., 1930. ISIS

Medals no. 35 : P. J. C. JANSSEN and J. N. LOCKYER. No. 36 : H. VON HELMHOLTZ. No. 37 : ALBERT I OF MONACO. No. 38 : CLAUDE BERNARD. No. 39 : PAUL BERT. No. 40 : M. BERTHELOT.

Sarton, George. The teaching of the history of science. *Isis*, 13, 272-97, 9130. ISIS

« I do not apologize for writing a third article on this subject. In all probability it is not the last one. There is no doubt that within the last ten years interest in the history of science has grown tremendously among scientists, historians, philosophers. Educators and college administrators are beginning to take notice of it. But we must not be surprised if this growing interest involves many misunderstandings, for we do not generally understand things until we have misunderstood them in various ways. It is as if we were turning around them and could not really comprehend them until we had seen them from many different angles. »

Sarton, George. Twenty-sixth critical bibliography of the history and philosophy of science and of the history of civilization (to March 1, 1929). *Isis*, 13, 142-268, 1929. ISIS

This Twenty-sixth Bibliography contains about 718 items, some of which have been kindly contributed by the following scholars :

H. G. BÉVENOT (Weingarten Abbey, Würtemb.); T. L. DAVIS (Cambridge, Mass.); C. H. DESCH (Sheffield); L. GUINET (Brussels); J. W. S. JOHNSSON (Copenhagen); E. KREMERS (Madison, Wis).; C. D. LEAKE (San Francisco); ALEXANDER MARX (New York); LYNN THORNDIKE (New York); J. K. WRIGHT (New York).

Sarton, George. Twenty-seventh critical bibliography of the history and philosophy of science and the history of civilization (to September 1929). *Isis*, 13, 400-602, 1930. ISIS

This Twenty-seventh Bibliography contains about 1338 items, some of which have been kindly contributed by the following scholars :

R. C. ARCHIBALD (Providence, R. I.); T. L. DAVIS (Camb. Mass.); F. M. FELDHAUS (Berlin); L. GUINET (Brussels); H. WIELEITNER (Munich); E. KREMERS (Madison, Wis.); A. POGO (Cambridge, Mass.); V. V. RAMANA-SASTRIN (Vedaraniam, S. India); J. K. WRIGHT (New York).

17. — ORGANIZATION OF SCIENCE

(Internal organization is meant, see Isis, 1, 195. *For external organization, national or international,* see *section* 55)

Baitsell, George Alfred. The evolution of earth and man. By LORANDE LOSS WOODRUFF, GEORGE HOWARD PARKER, RICHARD SWANN LULL, CHARLES SCHUCHERT, HARRY BURR FERRIS, JOSEPH BARRELL, ALBERT GALLOWAY KELLER, GEORGE GRANT MACCURDY, ELLSWORTH HUNTINGTON, JAMES ROWLAND ANGELL, EDWIN GRANT CONKLIN, WESLEY ROSWELL COE. Edited, with a preface, by GEORGE ALFRED BAITSELL. XV+476 p., 32 pl. New Haven, Yale University Press, 1929. ISIS

Reviewed in *Nature*, 125, 382, 1930. « This volume consists of a reprint of two volumes of elementary lectures, 'The evolution of the earth and its inhabitants' (1918), and 'The evolution of man' (1922), delivered at Yale University, with the addition of a chapter entitled 'Cultural evolution' by G. G. MACCURDY, and another on 'The mechanism of evolution', by W. R. COE. »

18. — PHILOSOPHY OF SCIENCE

Bliss, Henry Evelyn. The organization of knowledge and the system of the sciences. With an introduction by JOHN DEWEY. XX+433 p. New York, HOLT, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 378-79, 1930.

Hogben, Lancelot. Science and humanism. *The Realist*, 2, 370-83, 1929. ISIS

Sarlo, Francesco de. Scienza e filosofia. *Scientia*, 47, 81-90, 149-64, 225-44; traduction franç. *id.*, suppl., 37-46, 63-75, 95-112, 1930. ISIS

II. FORMAL SCIENCE (Knowledge of forms)

20. — MATHEMATICS

Bergfeld, Emil. Die Axiome der Euklidischen Geometrie psychologisch und erkenntnistheoretisch untersucht. *(Neue psychologische*

Studien, hrsg. von F. KRUEGER, III. Bd. : Grenzfragen der Philosophie, 2. Heft). S. 131-217, München, BECK, 1927. ISIS

Diese eingehende Untersuchung ist von dem Standpunkt aus durchgeführt, dass alles was uns überhaupt gegeben ist, also auch jedes unserer geometrischen Axiome, nur als Bewusstseinstatsache uns unmittelbar gegeben ist. Nach einer Einleitung über die vom Verfasser benützten philosophischen Begriffe geht er an die Erörterung der Axiome in der Form, die ihnen HILBERT gegeben hat. Über das Ergebnis kann ich nur sagen, dass Verf. die Axiome der Verknüpfung und der Anordnung allein als wirkliche Axiome anzusehen sich genötigt fand, die Axiome der Kongruenz und die der Stetigkeit hingegen als Postulatkonventionen. Das Parallelenaxiom will er als « Lehrsatz » aus den Axiomen der Verknüpfung und der Anordnung ableiten können. Das wird einiges Kopfschütteln hervorrufen. Auf die feineren Unterscheidungen kann ich nicht eingehen, da hiezu erst die vom Verf. verwendeten Begriffe (Erlebnisevidenz, Bedeutungsevidenz usw.) erklärt werden müssten. H. W.

Bortolotti, Ettore. Noterelle di storia della matematica. *Periodico di matematiche*, 10, 85-91, 1930. ISIS

Contains the following four notes : 1. La definizione matematica nelle Lezioni accademiche di EVANGELISTA TORRICELLI. 2. Sulla storia del teorema di PITAGORA. 3. PIETRO COSSALI ed i codici di LEONARDO PISANO. 4. La introduzione del segmento unitario nella costruzione geometrica delle formule algebriche. A. P.

Bortolotti, Ettore. Studi e ricerche sulla storia della matematica in Italia nei secoli XVI e XVII. VIII+246 p., 44 fig., 8 pl. Bologna, N. ZANICHELLI, 1928. ISIS

Reviewed by A. POGO, *Isis*, 13, 379-82, 1930.

Brand, Walther und **Deutschbein, Marie.** Einführung in die philosophischen Grundlagen der Mathematik. 4, 96 p. Frankfurt a. M., DIESTERWEG, 1929. H. W. ISIS

Cajori, Florian. Absurdities due to division by zero. *The Math. Teacher*, 22, 366-68, 1929. ISIS

Cajori, Florian. A history of mathematical notations. Vol. 2. Notations mainly in higher mathematics. XVII+367 p., 20 fig. Chicago, Open Court, 1929 (vol. 2, $ 6 ; the 2 vols., $ 12). ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 129-30, 1929.

Errera, Alfred. Exposé historique du problème des quatre couleurs. 1 fig. *Periodico di matematiche*, 7, 20-41, 1927. ISIS

Gandz, Solomon. The origin of angle-geometry. *Isis*, 12, 452-81, 1929. ISIS

Introductory. Geometry of lines and geometry of angles. 1. Ambiguity of the terms; 2. Geometry of lines and geometry of angles; 3. The geometry of angles. Angle geometry and trigonometry. II. The origin of angle-geometry. Angle-geometry among Egyptians, Babylonians and Greeks; 4. Greek tradition. Greek origin; 5. The modern historians. Egyptian origin advocated by German school; 6. Refutation in general; 7. Note of Chancellor A. B. CHACE; 8. The seqt; 9. Instinct and consciousness, intuition and science; 10. Historic and prehistoric phases in mathematics; 11. The origin of the geometry of lines and geometry of angles. III. The angle-geometry among the Hebrews and Arabs. 12. The Mishnath ha-Middoth and the geometry of AL-KHOWÂRISMÎ (c. 825). IV. The theorem of PYTHAGORAS (c. 540 B.C.). 13. The Hebrew form of the PYTHAGOREAN theorem; 14. The origin of the PYTHAGOREAN theorem. V. The perpendicular and the gnomon. 15. Terminology of the height; 16. Definition of the height; 17. The definition of OENOPIDES OF CHIOS (c. 450B. C.); 18. The right angle as a unit of measurement. VI. Lateral and angular definition of figures. 19. Were the figures named according to the number of their sides or of their angles? 20. Egyptian, Hebrew and Arabic usage. Not specified terminology; 21. The Greek usage. Specified terminology; 22. The problem and its solution; 22 bis. A curious fact; 23. The Roman and Hindu usage. VII. Brief summary and conclusion.

Gérard, Louis. Sur le problème de MALFATTI, le pendule de FOUCAULT et autres questions d'analyse et de physique. 64 p. Paris, VUIBERT, 1929. ISIS

Hofmann, Jos. E.; Wieleitner, Heinrich. Zur Geschichte der sog. Rytz-schen Achsenkonstruktion einer Ellipse aus einem Paar konjugierter Durchmesser. 22 p., 7 fig. *Nieuw Archief voor Wiskunde*, deel XVI, derde stuk, Groningen, 1930. ISIS

Jackson, Dunham. The theory of approximation. VIII+178 p. (*American Mathematical Society*; *colloquium publications*. Volume 11) New York, American Mathematical Society, 1930. ISIS

Contents: Continuous functions; 2. Discontinuous functions; functions of limited variation; arithmetic means; 3. The principle of least squares and its generalizations; 4. Trigonometric interpolation; 5. Introduction to the geometry of function space.

Kliem, Fritz. Humanismus und Mathematik. 60 p., 1 pl. (*Smmlg. Neudeutscher Humanismus*, 7. Bdchn.) Breslau, TREWENDT & GRENIER, 1929. ISIS

Reviewed by H. WIELEITNER, *Mitt. zur Geschichte der Medizin*, 29, 71, 1930.

Lietzmann, W. Aufbau und Grundlage der Mathematik. (*Math. Unterr.-Werk.* Erg.-Heft 3). 6, 89 p., map. Leipzig, TEUBNER, 1927. ISIS

Dieses schöne Büchlein ist eine philosophische Ergänzung zu allen Mathematikbüchern, die für die Oberstufen bestimmt ist. Es ist nur eine knappe Darstellung, als Leitfaden für Schüler gedacht, der die nähere Erläuterung des Lehrers voraussetzt. In 4 Kapiteln wird die in der Mathematik angewendete Logik (Begriffe, Definitionen, Schlüsse, Induktion, usw.), dann die Grundlegung der Geometrie, der Arithmetik, und der Analysis besprochen. Welchen Reichtum das Heft fasst, sieht man daraus, dass es im ganzen 85 Untertitel enthält. Es wird jedem Lehrer, auch wenn er nicht nach dem Lietzmannschen Unterrichtswerk lehrt, ein wichtiger Behelf sein, weil diese Dinge bisher noch nie so zusammengestellt wurden. H. W.

Luckey, P. Anschauliche Summierung der Quadratzahlen und Berechnung des Pyramideninhalts. *Zeitschr. f. mathem. u. naturw. Unterr.* 90, Heft 4, 145-58, 14 fig., 1930. ISIS

The reading of this paper is recommended to students of Egyptian mathematics. It is also very interesting from the methodological point of view. G. S.

Murray, David (1842-1928). Chapters in the history of bookkeeping, accountancy and commercial arithmetic. VI+519 p. Glasgow, JACKSON, 1930. ISIS

The late DAVID MURRAY well known by his Museums, their history and their use (1904), Memories of the Old College of Glasgow (1927), and a great many archaeological publications had just read the final proofs of this book, save the index, at the time of his death in October 1928. It was seen through the press by his daughter, Miss SYLVIA W. MURRAY. A lectureship has been founded in his memory at the University of Glasgow, which he loved so well. Miss ELIZABETH H. ALEXANDER (See *Isis*, 7, 581; 12, 147) modelled a beautiful bas-relief of him which she presented to the University; it will be placed among the large collection of books bequeathed by him to the University Library. Contents : Bookkeeping and accountancy in Scotland in the seventeenth and eighteenth centuries; Bookkeeping and accountancy in early times; Juridical accounting, mathesis sive arithmetica forensis; Some writers on bookkeeping; Early arithmetic; Some writers on commercial arithmetic and bookkeeping. G. S.

Sánchez Pérez, José A. Las matemáticas en la Biblioteca del Escorial. Obra premiada por la Real Academia de Ciencias Exactas, Fisicas y Naturales de Madrid. 365 p., 61 pl. Madrid, Imprenta de ESTANISLAO MAESTRE, 1929. ISIS

Reviewed by G. SARTON, *Isis*, 13, 128-9, 1929.

Sanford, Vera. A short history of mathematics. Under the editorship of JOHN WESLEY YOUNG. With an introduction by DAVID EUGÈNE SMITH. XII+412 p., ills., maps, tables. Boston, HOUGHTON MIFFLIN, 1930. (3.75). ISIS

The maturity of the history of mathematics is proved by the publication

in quick succession of many textbooks. Such publication is made possible by the existence on the one hand of larger treatises and abundant monographs, on the other hand, of a sufficient public. Miss Sanford (of the School of Education, Western Reserve University, Cleveland, Ohio) is a pupil of David Eugène Smith's and hence we may be sure that she has received an excellent training. She proved her own capacity a few years ago in her study of The history and significance of certain standard problems in algebra (110 p., New York, 1927; *Isis*, 11, 239). Her textbook is pleasantly written and contains abundant and well chosen illustrations. It is divided as follows : 1. Men who made mathematics; 2. Arithmetic; 3. Commercial mathematics; 4. Algebra; 5. Verbal problems; 6. Practical geometry; 7. Demonstrative geometry; 8. Trigonometry; 9. Analytic geometry; 10. Calculus; 11. Theory of numbers; 12. Calculating devices; 13. Weights and measures; 14. The place of mathematics in the school curriculum. The first chapter (71 p.) is a general chronological introduction in the form of a series of tabloid biographies of the main mathematicians down to Gauss; the rest of the book is then arranged in topical order, only elementary subjects being dealt with. It will be a very easy book to teach from, and hence I hope that it will contribute to the diffusion of the historical point of view among young mathematicians.

G. S.

Vetter, Quido. Finden sich in Böhmen noch Spuren der alten Mediatio und Duplatio? 8 p. (*Cahiers scientifiques*, no. 1. Cluj. 1 mars 1930). Cluj, Institutul de Arte Grafice « Ardealul », 1930. ISIS

Wieleitner, Heinrich. Die Entwicklung des mathematischen und naturwissenschaftlichen Unterrichts in Bayern. Sonderdruck aus der *Festschrift des Deutschen Vereins zur Förderung des mathematischen und naturwissenschaftlichen Unterrichts*, 53-64, Würzburg, 1930.

ISIS

Young, John Wesley. Projective geometry. IX+185 p., 64 fig. (*The Carus Mathematical Monographs*, no. 4). Chicago, Open Court, 1930. ISIS

« Projective Geometry may be approached by various routes : postulational or intuitive, synthetic or analytic, metric or purely projective. In a monograph which is to give a first approach to the subject it has seemed to me that the treatment should be based on intuition, should develop the subject by synthetic methods, and should keep projective properties sharply distinguished from the metric specializations. »

21. — STATISTICS

(History and methods. Tables and generalities. For the applications, refer to the sciences to which they are applied.)

Walker, Helen M. Studies in the history of statistical method. With

special reference to certain educational problems. VIII+229 p., 12 illus. Baltimore, WILLIAMS and WILKINS, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 382-3, 1930.

III. PHYSICAL SCIENCES (Knowledge of inorganic nature)

22. — MECHANICS *(Including celestial and atomical mechanics)*

Chazy, Jean. La théorie de la relativité et la mécanique céleste. VIII+ 261 p. Paris, GAUTHIER-VILLARS, 1930. ISIS

Goditsky-Tsvirko, A. M. An outline of the history of the funicular polygon. Reprinted from the *Publications of the Institute of Communication Engineering*, No. 101. 26 p., 23 figs. Leningrad, Institute of Communication Engineering, 1929. (In Russian). ISIS

This paper was written in 1927, a century after the publication, in the *Journal des voies de communications* (both in the Russian and in the French editions), in 1826 and 1827, of the contributions of LAMÉ and CLAPEYRON to the theory of the funicular polygone and of suspension bridges. GABRIEL LAMÉ (1795-1870) and B. P. E. CLAPEYRON (1799-1864) were, from 1820 to 1832, professors at the Inst[illegible] Communication Engineering (founded, 1810) in St. Petersburg. The author outlines—with a reproduction of the more important original figures and proofs—the history of the funicular polygon from LEONARDO, ROBERVAL, and GALILEO to the « spartostatics » of SIMON STEVIN, then the work of LEIBNIZ, HUYGENS, JOHANN and JACOB BERNOULLI, DAVID GREGORY (1661-1708), NEWTON, and VARIGNON. A sketch of the history of suspension bridges follows, illustrated by projects executed or abandoned between 1823 and 1826, in Paris, St. Petersburg, and Moscow. The pamphlet ends with an analysis of the above mentioned papers by LAMÉ and CLAPEYRON, and a discussion of their bridge-building activities.

A. P.

23. — ASTRONOMY

Bigourdan, G. Le Bureau des longitudes (3e partie). Notice A dans l'Annuaire pour l'an 1930. 110 p., 4 fig., Paris, GAUTHIER-VILLARS, 1930. ISIS

Catalogus codicum astrologorum Graecorum. Codices athenienses descripsit ARMANDUS DELATTE. Tomus X. VIII+291 p. Bruxelles, LAMERTIN, 1924. ISIS

Vols. I to VIII of this Catalogus were registered in *Isis*, 6, 206. Vol. 9 I have not yet seen. The list of Athenian astrological MSS. is very short, 29 MSS. the description of which hardly covers more than 50 p.; the largest part of the book is devoted to extracts (c. 200 p.). This is thus in reality an anthology of Greek astrology; most of it is the lowest kind of astrology. For the author, see *Isis*, 12, 328-30. G. S.

Macpherson, Hector. Modern cosmologies : a historical sketch of researches and theories concerning the structure of the universe. VII+131 p., 12 pl. London, Oxford University Press, 1929. ISIS

Schoch, Carl. Die Neubearbeitung der Syzygientafeln von OPPOLZER. II+6 p. (*Mitteilungen des Astronom. Rechen-Instituts Berlin-Dahlem*, Bd. 2, Nr. 2). Kiel, 1928. ISIS

Reviewed by P. V. NEUGEBAUER, *Orientalistische Literaturzeitung*, 33, 13, 1930. SCHOCH's tables were printed before it was definitely established that the data used by HIPPARCHOS for the determination of the distance of the sun were those of the AGATHOCLES eclipse (—309), not of the so-called HIPPARCHOS eclipse (—128). P. V. NEUGEBAUER gives, on p. 133 of his *Astronomische Chronologie* (reviewed in *Isis*, 14,450, 1930),a table of corrections to be applied to the quantity P of SCHOCH's tables. A. P.

Shapley, Harlow and **Howarth, Helen E.** A source book in astronomy. XVI+412 p., illustrated. New York, MCGRAW-HILL Book Company, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 130-34, 1929.

Troels-Lund, Troels Frederik (1840-1921). Himmelsbild und Weltanschauung im Wandel der Zeiten. Autorisierte vom Verfasser durchgesehene Übersetzung von LEO BLOCH. Fünfte Auflage. V+276 p. Leipzig, TEUBNER, 1929 (cloth, 8 RM.). ISIS

The Danish original was published, in 1901, as the 13th and last volume—*Livsafslutning*—of the *Dagligt liv i Norden i det 16de aarhundrede*, Copenhague, 1880-1901; the *Livsafslutning* became vol. 14 when the collection was rechristened *Danmarks og Norges historie i slutningen af det 16de aarhundrede*, and the 1879 edition of *Land og folk* added as vol. 1. The first edition of LEO BLOCH's translation appeared in 1899/1900. The present 5th edition is an unchanged reprint of the 4th edition published in 1913; even the pagination is preserved. The Anmerkungen und Hinweise at the end of the volume contain the same 209 items as all the previous editions; the following new note precedes the bibliography : « Eine vollständige Bibliographie findet sich in der dritten, von W. GUNDEL besorgten Auflage des Werkes : BOLL-BEZOLD, *Sternglaube und Sterndeutung*, Leipzig 1926. Dort sind auch diejenigen Forschungsresultate mitgeteilt, die seit der Abfassung des vorliegenden Buches den Begriff von der Geschichte der Sternkunde z. T. grundsätzlich umgestaltet haben. Zu vergleichen sind ferner : W. GUNDEL, *Sterne u. Sternbilder im Glauben des Altertums und der Neuzeit*, Bonn 1922. L. THORNDIKE, *A history of magic and experimental science*, New York 1923. » The book consists of an introduction (p. 3-7); seventeen chapters on Antiquity and the Orient, « Entstehung der Bestandteile der Weltanschauung des 16. Jahrhunderts » (p. 11-166); eleven chapters on XVIth century Europe, « Mischung der Bestandteile der Weltanschauung des 16. Jahrhunderts » (p. 169-244); two XIXth-century chapters, « Auflösung und Neubildung in der Neuzeit » (p. 247-265); and the already mentioned Anmerkungen

und Hinweise (p. 266-276). At the end of the table of contents the following note is added : « Der Einband-Vignette liegt eine antike Gemme zugrunde : HIPPARCH (?) vor dem Globus sitzend und mit dem Zirkel auf ihm messend. (WINCKELMANN-Programm, 1846). » A. P.

Zinner, Ernst. Alte Sonnenuhren an Bamberger Gebäuden. *XXV. Bericht der Naturforschenden Gesellschaft in Bamberg*, 58-62, 1929. ISIS

Zinner, E. Die Sternkundliche Abteilung des deutschen Museums von Meisterwerken der Naturwissenschaft und Technik zu München. *Die Sterne*, 5, 125-33, 3 figs., Potsdam, 1925. ISIS

Zinner, E. Tidsmaaling ved Hjaelp af Sol- og Stjerneure. 8 p., 5 fig. *Saertryk af Nordisk Astronomisk Tidsskrift*, Bind 9, No. 4, 1928. ISIS

Zinner, E. Wege und Ziele der Geschichte der Sternkunde. *Die Sterne*, 5, 149-56, Potsdam, 1925. ISIS

24. — PHYSICS

Cajori, Florian. History of determinations of the heights of mountains. *Isis*, 12, 482-514, 13 fig., 1929. ISIS

« There have been in vogue three methods of measuring elevations of mountains above adjacent plains or above the level of the sea : The geodetic method, the barometric method, and the boiling point method. Of these, the geodetic method is the oldest and at the same time the most accurate of recent time. It may be considered under three heads involving, respectively, three more or less distinct processes : Determination of heights (1) by leveling, (2) by measurement of triangles, (3) by determining the distance a mountain is visible at sea. »

Forti, Umberto. Le concezioni della luce da DEMOCRITO a CARTESIO. 3 figs. *Periodico di matematiche*, 8, 90-102, 1928. ISIS

Johnson, E. H. The evolution of physical concepts. *School Science and Mathematics*, 30, 283-91, 1930. ISIS

Richard, P. J. La gamme. Introduction à l'étude de la musique. Préface de MARIUS CASADESUS. VIII+232 p., Paris, HERMANN et Cie, 1930. (28 fr.) ISIS

Très clair, très précis, ce petit traité didactique de P. J. RICHARD « d'où toute considération d'ordre purement esthétique est bannie », suit en quelque sorte l'ordre historique dans chacun de ses chapitres, dont il me suffira de donner le contenu. 1. Les notions arithmétiques indispensables; 2. La gamme

de PYTHAGORE; 3. La gamme d'ARISTOXÈNE; la gamme de ZARLIN; la gamme de DELEZENNE; 4. La gamme des musiciens et la gamme tempérée; 5. Acoustique musicale; 6. La gamme naturelle; 7. Modes anciens (musique grecque, plein chant), mode mineur; 8. Tuyaux sonores; 9. Accords et dissonances, théorie d'HELMHOLTZ; 10. Du choix d'une gamme. Écrit pour les jeunes musiciens, le livre de RICHARD pourra être lu très avantageusement par tous ceux qui s'intéressent à l'acoustique, et par bon nombre de professeurs de physique. L. G.

Rosenfeld, L. EDMUND HOPPE (geb. 1854, 02, 25, gest. 1928, 08, 12.). *Isis*, 13, 45-50, pl., 1929. ISIS

German historian of physics. Biography and portrait.

25. — CHEMISTRY, PHYSICO-CHEMISTRY, INDUSTRIAL CHEMISTRY

Blokh, M. A. Biographical reference book of chemists. Prominent chemists and scientists of the XIXth and XXth centuries who have worked in domains of science bordering on chemistry. (In ussian). Volume I. XLIV+512 p., 44 portraits, Leningrad, Chem.-techn. Press, 1929. ISIS

Reviewed by A. POGO, *Isis*, 13, 383-86, 1930.

Bugge, Günther. Das Buch der grossen Chemiker. Unter Mitwirkung namhafter Gelehrter. 496 S., 62 Abb. Berlin, Verlag Chemie, 1929. ISIS

Das Buch enthält 38 Biographien, beginnend mit ZOSIMOS im 4. Jahrhundert und endigend mit SCHÖNBEIN im 19. Jahrhundert. Sämtliche Biographien sind von bekannten Historikern der Chemie bearbeitet. Ich nenne nur : BLOCH-Leningrad, DARMSTAEDTER-München, LOCKEMANN-Berlin, OSTWALD-Grossbothen, RUSKA-Berlin und STRUNZ-Wien. Behandelt werden folgende Chemiker : ZOSIMOS, DSCHABIR, ALBERTUS MAGNUS, ROGER BACON, RAYMUNDUS LULLUS, PSEUDO-GEBER, BIRINGUCCIO, PARACELSUS, AGRICOLA, LIBAVIUS, PSEUDO-BASILIUS VALENTINUS, VAN HELMONT, GLAUBER, BOYLE, STAHL, BOERHAAVE, GEOFFROY D. Ä., MARGGRAF, BLACK, CAVENDISH, PRIESTLEY, SCHEELE, LEBLANC, LAVOISIER, KLAPROTH, BERTHOLLET, PROUST, FOURCROY, VAUQUELIN, RICHTER, DALTON, GAY-LUSSAC, THENARD, DAVY, FARADAY, BERZELIUS, MITSCHERLICH, SCHÖNBEIN. Dazu gute Namen- und Sachregister. Das Ganze eine überaus sorgfältige und doch fast in allen Teilen leicht lesbare Arbeit. F. M. FELDHAUS.

Egloff, Gustav ; Lowry, C. D., jr. Distillation methods, ancient and modern. 11 p., 10 fig. *Industrial and Engineering Chemistry*, 21, p. 920, 1929. ISIS

« Many of the principles which are fundamental in the design of present-day distillation apparatus were widely employed in alchemical practice. Among these principles are (1) taking several streams from a fractionating tower,

(2) refluxing, (3) external regulation of still-head temperature, (4) reboiling of condensates for increased fractionation, (5) preheating liquid before distillation, (6) feeding liquid into the still while in operation. »

Hille, Hermann. A history of colloids in medicine. *Medical life*, 37, III—63, 24 ills., 1930. ISIS

Lippmann, Edmund O. von. Die Geschichte des Wismuts zwischen 1400 und 1800. Ein Beitrag zur Geschichte der Technologie und der Kultur. 42 p. Berlin, SPRINGER, 1930 (RM. 2.80). ISIS

This monograph on the history of bismuth by the master historian v. LIPPMANN needs no recommendation; we may be sure that it is as thorough and as complete as possible. It is subdivided as follows: 1. Vorbemerkung; 2. Angebliche älteste Erwähnungen des Wismuts; 3. Erste Nachrichten über Wismut; 4. Das Wismut und die Erfindung des Buchdruckes; 5. Herkunft des Namens Wismut; 6. Das Wismut im 17. Jahrhundert; 7. Das Wismut im 18. Jahrhundert; 8. Rückblick. Namen- und Sachverzeichnis. G.S.

Singer, Dorothea Waley. Catalogue of Latin and vernacular alchemical manuscripts in Great Britain and Ireland dating from before the XVI century by D. W. SINGER assisted by ANNIE ANDERSON and by ROBINA ADDIS. Volume 2. VIII+331-755 p. (Union académique internationale.) Brussels, LAMERTIN, 1930. ISIS

The first volume of this catalogue was fully reviewed in *Isis*, vol. 12, 168-69. I then gave the table of contents of the whole work. Judging by that table we may still expect a third volume containing appendices and indices. The whole work will be indispensable to students of mediaeval alchemy. Let us hope that the indices will soon appear. G. S.

26. — TECHNOLOGY

(For mining, see 32. *geology*; *for industrial chemistry*, 25. *chemistry. See also Arts and crafts under* 45*)*

Feldhaus, Franz Maria. Technische Museen. *Archeion*, 17, 348-57, 1929. ISIS

L'auteur examine, en suivant l'ordre de leur fondation, 46 musées intéressant la technologie; plusieurs d'entre les plus anciens ont d'ailleurs disparu sans qu'on puisse trouver trace de leurs collections. L. G.

GilFillan, S. C. Inventiveness by nation. A note on statistical treatment. *Geographical Review*, 20, 301-04, 1930. ISIS

Guillet, Léon. L'évolution de la métallurgie. II+196 p., 37 fig. *(Nouvelle collection scientifique)* ALCAN, Paris, 1928 (15 fr.). ISIS

« Ce petit livre n'a nullement la prétention d'être le bref résumé d'un

traité de métallurgie; il ne veut pas non plus examiner un point particulier de cette industrie d'importance capitale ou étudier certains phénomènes, objets de recherches récentes ayant eu des répercussions sur les fabrications. Nous avons simplement cherché à indiquer brièvement les magnifiques progrès faits depuis 1850, en général, dans les méthodes métallurgiques elles-mêmes et dans les produits obtenus ». L'ouvrage se présente donc sans grande prétention. Il est excellent, en ce qu'il montre surtout et sans cesse comment les transformations de la fabrication et des traitements des produits métallurgiques ont été déterminés par les recherches scientifiques. L. G.

Hendrichs, Franz. Die Entwicklung der Solinger Schwert- und Messerzünfte bis zum Dreissigjährigen Krieg. *Beiträge zur Geschichte der Technik und Industrie*, 19, 113-20, 8 fig., Berlin, 1929. ISIS

Horwitz, Hugo Th. Die Anfänge von Wellenkupplungen und Wellentransmissionen. *Beiträge zur Geschichte der Technik und Industrie*, 19, 144-46, 10 fig., 1929. ISIS

Pupin, Michael I. Romance of the machine. VI+111 p. New York, SCRIBNER'S, 1930. ISIS

Zuman, Franz. Die böhmischen Glashütten und Industrie der Glaskompositionssteine. *Beiträge zur Geschichte der Technik und Industrie*, 19, 54-60, 7 fig., Berlin, 1929. ISIS

IV. BIOLOGICAL SCIENCES (Knowledge of organic nature)

27. — BIOLOGY *(Generalities, « Natural history »)*

Cuénot, L. Le transformisme n'est-il qu'une illusion ou une hypothèse téméraire? *Revue générale des sciences*, 41, 17-21, 1930. ISIS

Driesch, Hans. Behaviorismus und Vitalismus. 10 p. *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, philosophisch-historische Klasse*, Jahrgang 1927-28. 1. Abhandlung, 1927. ISIS

Monakow, C. v.; Mourgue, R. Introduction biologique à l'étude de la neurologie et de la psychopathologie. Intégration et désintégration de la fonction. XI+416 p., 33 figs., 2 pl. Paris, ALCAN, 1928 (80 frs.). ISIS

Reviewed by Prof. LHERMITTE, *Encéphale*, n° 5, mai 1928; Prof. LAIGNEL-LAVASTINE, *Revue neurologique*, sept. 1928; R. TROUDE, *Revue scientifique*, 27 avril, 1929; Prof. PIÉRON, *Année psychologique*, t. 29, 1929; J. JANKELEVITCH,

Revue de métaphysique et de morale, n° 2, 1929; Prof. H. WALLON, *Revue philosophique*, septembre-octobre, 1929; Prof. SABRAZÉS, *Gazette hebdomadaire des sciences médicales de Bordeaux*, 24 nov., 1929; G. MATISSE, *Année biologique*, t. 4, 1929, facs. 1, première partie (physiol. générale), p. 125-126; S. A. K. WILSON, *Journal of neurology and psychopathology*, January, 1929; S. E. JELLIFFE, *Journal of nervous and mental diseases*, January, 1929; Prof. ADOLF MEYER (Baltimore). *Der Nervenarzt* (Berlin), 2 Jahrg., H. 8, 1929; A. ZIVERI, *Il Cervello* (Napoli), Anno 7, n° 5, 15 ottobre 1928; Prof. C. WINKLER (Utrecht) *Archives suisses de neurologie et de psychiatrie*, vol. 23, 1929; C. T. VAN VALKENBURG, *Nederl. Tijdschrift voor Geneeskunde*, 1928; Prof. MORSELLI, *Quaderni di psichiatria*, 1928; Prof. BLENLER, *München. mediz. Wochenschrift*, Nr. 30, 1929; FLEISCHHACKER, *Klin. Wochenschr.*, 25, Nov. 1928; Prof. SPIEGEL, *Zentralblatt für die ges. Neurol.- und Psych.*, Bd. 50, H. 10/11, 15 Sept., 1928; Prof. F. H. LEWY, *Deutsche mediz. Woch.* Nr. 36, Sept. 1928; LEVI BIANCHINI, *Archivio generale di neurologia e psichiatria*, 1928; Prof. P. SCHILDER, *Zeitschr. f. Psychotherapie*, Bd. 1, 642-43, 1928; Prof. W. RIESE, *Berichte für die ges. Physiologie*, 1930; E. KESSLER, *Der Kleine Bund* (Bern), 16 märz 1930; O. SITTIG, *Beiträge zur ärztl. Fortbildung*, Jahrg. 8, Nr. 4, 24 Februar, 1930.

Needham, Joseph. The sceptical biologist (ten essays). v+288 p. London, CHATTO and WINDUS, 1929. ISIS

Reviewed by A. D. R., *Nature*, 125, 374, 1930.

Osborn, Henry Fairfield. From the Greeks to DARWIN. Second edition, revised and extended to embrace recent scholarship. XVI+398 p. New York, SCRIBNER'S, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 386-88, 1930.

Thompson, J. Arthur. L'hérédité. Traduit d'après la cinquième édition anglaise par HENRI DE VARIGNY. 570 p. *(Bibliothèque scientifique)*. Paris, PAYOT, 1930. ISIS

28. — BOTANY

(Agronomy, phytopathology, palaeobotany)

Lippmann, Edmund O. von. Geschichte des Zuckers seit den ältesten Zeiten bis zum Beginn der Rübenzucker-Fabrikation. Ein Beitrag zur Kulturgeschichte. Zweite Auflage mit einem Titelbild und einer Landkarte. IX+824 p. Berlin, SPRINGER, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 393-95, 1930.

Meyer, Erich. Beitrag zur Entwicklungsgeschichte der Phytopathologie und des Pflanzenschutzes. Unter besonderer Berücksichtigung folgender Krankheiten: Honigtaukrankheit, Mehltaukrankheit, Mutterkorn, Russtau, Rost des Getreides, Brand des Getreides. *Archiv*

für Geschichte der Mathematik, der Naturwissenschaften und der Technik, 12, 236-68, 1930. ISIS

Reiche, Karl. Geografía botánica de Chile. (Grundzüge der Pflanzenverbreitung in Chile. Leipzig 1907). Por el Dr. KARL REICHE traducido del alemán por GUALTERIO LOOSER con varias ampliaciones y notas del traductor. *Revista chilena de historia y geografía*, T. 62, no. 66, 127-605, T. 63, no. 67, 205-36, 1929 (to be continued). ISIS

The first part of this translation in vol. 62 of the *Revista* consists of two chapters : Chapter 1 consists of a history of the botanical exploration of Chile, Chapter 2 of a bibliography of Chilean flora. J. K. W.

Stapf, O. Index Londinensis to illustrations of flowering plants, ferns and fern allies. Being an emended and enlarged edition continued up to the end of the year 1930 of PRITZEL's alphabetical register of representations of flowering plants and ferns, compiled from botanical and horticultural publications of the XVIIIth and XIXth centuries. Prepared under the auspices of the Royal Horticultural Society of London at the Royal Botanic Gardens, Kew, by O. STAPF. Vol. 2. IV+548 p. Oxford, Clarendon Press, 1930. ISIS

Reviewed by W. C. W., *Nature*, 125, 523, 1930.

29. — ZOOLOGY

Bodenheimer, F. S. Materialien zur Geschichte der Entomologie bis LINNÉ. Band I, X+498 p., 155 fig., 24 pl. Berlin, JUNK, 1928. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 388-92, 1930.

Carpenter, F. M. A review of our present knowledge of the geological history of the insects. 34 p. *Psyche*, 37, 1930. ISIS

Gerould, John, H. History of the discovery of periodic reversal of heart-beat in insects. *Biological Bulletin*, 56, 215-25, 1929. ISIS

History from MALPIGHI's Dissertatio epistolica de bombyce (London, 1669) down to GEROULD (1924).

Gerould, John H. History of the discovery of periodic reversal of heart-beat in insects. Supplementary note. *Science*, 71, 264-65, 1930. ISIS

« Periodic reversal in Lepidoptera, discovered by MALPIGHI in 1669, expressly denied in the first half of the nineteenth century by such excellent observers as HEROLD (1823) and VERLOREN (1844), confirmed for the chrysalis (silkworm) by CORNALIA (1856), was first adequately described by BATAILLON (1893, 1894). »

Gerould, John H. Periodic reversal of heart-heat in Bombyx and other moths. I. International Congress of Entomology, Ithaca, August, 1928, volume 2, 516-22. Naumburg a. S. 1929. ISIS

« It is the purpose of the present paper to bring out the fact, hitherto unnoticed, that periodic reversal of heart action occurs in Lepidoptera generally, not merely in the prepupa and pupa, as BATAILLON and FISCHER found, but also throughout adult life. We are this year celebrating the 300th anniversary of the publication of HARVEY's epoch-making *De motu cordis*. In 1628, also, MARCELLO MALPIGHI was born, who extended HARVEY's work by discovering circulation through the capillaries. To him we owe the first description of periodic reversal of heart-beat in the silkworm moth, a description vivid and substantially correct, though his conception of the dorsal vessel in the moth as a series of chambers or little hearts (corcula) was erroneous. It is astonishing that this interesting phenomenon, so readily observed in any large moth or butterfly, has for three centuries almost escaped notice. Seldom, if ever, has a discovery remained so long in oblivion. »

Gudger, E. W. Some old-time figures of the shipholder, Echeneis or Remora, holding the ship. *Isis*, 13, 340-52, 9 figs., 1930. ISIS

« I have elsewhere brought together the various legends of the shipholder and have given four explanations, of which one is purely mythical to fit the legends, and three are founded on fact. The mythical one is that the remora adhering to the ship, preferably by prow or keel, acts as a rudder, turning the ship hither or yon, or causing it to stand still. This myth or legend was very popular during classical, mediaeval and renaissance times as is attested by the large number of accounts brought together in my paper. While writing this it struck me that this story should have been a fertile field for the illustrators of those days, but I found only one figure of it. However, by working through various old books on emblems and symbols as well as old encyclopeadias and natural histories, I have lately found a number of other figures. These are very quaint and very interesting, and it has seemed worthwhile to bring them together with some brief descriptions. »

Ivanow, Elie. L'insémination artificielle des mammifères en tant que méthode scientifique et zootechnique. *Revue générale des sciences*, 41, 73-80, 1930. ISIS

Miller, Gerrit S. Jr. Mammals eaten by Indians, owls, and Spaniards in the coast region of the Dominican Republic. *Smithsonian Miscellaneous Collections*, vol. 82, No. 5. 16 p., 2 pl. Washington, Smithsonian Institution, 1929. ISIS

« The material... furnishes the means to identify all four of the native mammals, the hutia, the quemi, the mohuy and the cori, that OVIEDO said were habitually eaten by both natives and Spaniards during the early years of the sixteenth century; and finally it shows beyond the possibility of reasonable doubt that this recently extinct fauna included a ground sloth. The identity of only two of the mammals that OVIEDO ascribed to the island of Hispaniola

remains to be determined—the « dumb dog » and the indigenous rat. The few dog bones collected appear to differ in no way from the corresponding parts of European dogs, and there is nothing to prove that they represent the native breed. Hence the status of the famous « perro mudo », the dog that was unable to bark, is still as much of a mystery as ever. Equally obscure is the question as to whether or not there were rats on the island at the time of its discovery. OVIEDO relates that on inquiring into this matter he found those who told him that « mures o ratones » did in fact then exist; a cricumstance that appeared to him quite believable because these animals were so well known to be generated, like flies, mosquitoes, wasps, and grubs, anywhere, out of any kind of putrifying matter, a not unnatural belief at the time when he wrote, more than 125 years before FRANCISCO REDI had published his « Esperienze intorno alla generazione degl' insetti. » Nevertheless our search has failed to reveal a trace of rats or mice other than the European species that could have easily been brought by the Spaniards on their ships. » The first mention of some of the mammals discussed above is found in OVIEDO dela natural hystoria delas Indias (Toledo, 1526).

A. P.

Rolet, Antonin. Le crin de Florence. *Revue générale des sciences*, 41, 81-7, 6 fig., 1930. ISIS

V. SCIENCES OF THE EARTH (implying knowledge of both organic and inorganic nature)

31. — GEOGRAPHY AND OCEANOGRAPHY

Arktis. Vierteljahrschrift der internationalen Studiengesellschaft zur Erforschung der Arktis mit dem Luftschiff. Vol. 1. Gotha, JUSTUS PERTHES, 1928. ISIS

Ausserer, Karl. Der « Atlas BLAEU der Wiener National-Bibliothek ». *Beiträge zur historischen Geographie, Kulturgeographie, Ethnographie und Kartographie, vornehmlich des Orients*, hrsg. von HANS MZIK, p. 1-40, 4 pls. Leipzig, DEUTICKE, 1929. ISIS

The so-called « BLAEU Atlas » of the Vienna National Library is a magnificent collection of manuscript, hand-colored, and engraved maps, city and battle plans, landscape views, etc., filling no less than 50 folio volumes. These materials, brought together by LAURENZ VAN DER HEM (b. 1621) of Amsterdam, are described fully.

J. K. W.

Colin, Elicio. XXXVIIIe Bibliographie géographique 1928. Publiée avec la collaboration de l'« American Geographical Society ,, du « Comitato geografico nazionale Italiano », de la « Royal Geographical Society (London) » de la « Société Royale de Géographie d'Egypte », et avec le concours de la « Fédération des Sociétés Françaises de Sciences Naturelles ,. 624 p. Paris, COLIN, 1929. ISIS

The present volume contains 3062 notes, of which 694 deal with general (as opposed to regional) geography. 103 notes are devoted to the history of geography and 128 to historical geography. A most useful publication.
G. S.

Donazzolo, Pietro. I viaggiatori veneti minori. Studio bio-bibliografico. (*Memorie della Reale Società Geografica Italiana*, vol. 16). 412 p., index. Rome, 1927. ISIS

Supplements the great work of AMAT DI S. FILIPPO, *Studi biografici e bibliografici sulla storia della geografia in Italia*, 2 vols. 2nd. ed., Rome, 1882. Brief sketches and full bibliographical details are given regarding 392 travelers (970-1890 A.D.) as against only 105 Venetians listed by AMAT.
J. K. W.

Ekwall, Eilert. English river names. XCII+488 p. Oxford, Clarendon Press, 1928. ISIS

Greenland. Published by the Commission for the direction of the geological and geographical investigations in Greenland. Editors: M. VAHL, G. C. AMDRUP, L. BOBÉ, AD. S. JENSEN. Vol. 1: The discovery of Greenland, exploration and nature of the country. 575 p. Vol. 2: The past and present population of Greenland. IV+415 p. Vol. 3: The colonization of Greenland and its history until 1929. V+468 p. Copenhagen, REITZEL, 1928-1929. ISIS

Vol. 2 reviewed by J. M. WORDIE, *Nature*, 125, p. 442, 1930.

Hayes, J. Gordon. Antarctica. A treatise on the Southern Continent. London, RICHARDS, 1928. ISIS

Komroff, Manuel. Contemporaries of MARCO POLO. Consisting of the Travel records in the eastern parts of the world of WILLIAM OF RUBRUCK (1253-1255); the Journey of JOHN OF PIAN DE CARPINI (1245-1247); the Journal of Friar ODORIC (1318-1330); and the Oriental travels of Rabbi BENJAMIN OF TUDELA (1160-1173). XXIII+358 p. London, JONATHAN CAPE, 1928. ISIS

Krabbe, Th. N. Greenland: its nature, inhabitants and history. Translated from the Danish by ANNIE I. FAUSBOLL. XVI+129+IX p., 170 pl. Copenhagen, LEVIN and MUNKSGARRD, 1930. ISIS

Reviewed by R. N. R. B., *Nature*, 125, 379, 1930.

Longnon, Auguste. Les noms de lieux de la France. Leur origine, leur signification, leurs transformations. 5 fascicules. Paris, MARICHAL, 1920-29. ISIS

Reviewed by ALBERT DAUZAT, *Larousse mensuel*, 8, 311-12, 1930.

Lubimenko, Inna. Le rôle comparatif des différents peuples dans la découverte et la description de la Russie. *Revue de synthèse historique*, 48, 37-56, 1929. ISIS

Németh, Julius. Magna Hungaria. *Beiträge zur historischen Geographie, Kulturgeographie, Ethnographie und Kartographie, vornehmlich des Orients*, hrsg. von HANS MZIK, p. 92-98. Leipzig, DEUTICKE, 1929. ISIS

Traces the origin of the name « Magyar ». J. K. W.

Nunn, George E. Origin of the Strait of Anian concept. 36 p., maps. Philadelphia, privately printed, 1929. ISIS

Reviewed in *Geographical Review*, 20, 353-4, 1930.

Oldham, R. D. Earth movements in the delta of the Rhone. *Nature*, 601-04, 3 fig., 1930. ISIS

Reparaz, Goncal de. Els mapes catalans de la Bibliothèque Nationale de Paris. 18 p. (Extret dels *Estudis Universitaris Catalans*, XIII). ISIS

Notes on maps of the 14th to 17th centuries, inclusive. J. K. W.

Reparaz, Goncal de. Historia dels descobriments geografics. Vol. 1. Els primers viatgers (*Colleccio popular Barcino*, 26), 66 p. 12 fig.; Vol. 2. Els viatgers medievals (*Colleccio popular Barcino*, 38), 70 p. 14 fig. Barcelona, BARCINO, 1927-1928. ISIS

Rey, Charles F. The romance of the Portuguese in Abyssinia: an account of the adventurous journeys of the Portuguese to the empire of Prester John; their assistance to Ethiopia in its struggle against Islam, and their subsequent efforts to impose their own influence and religion, 1490-1633. 319 p., 16 pl. London, WITHERBY, 1929. ISIS

Reviewed in *Nature*, 125, 631, 1930.

Sharp, Henri A. An historical catalogue of Surrey maps. 56 p. Croydon, The Central Library, 1929. ISIS

(Sweden). Svenska Lantmäteriet 1628-1928; Historisk skildring utgiven av Sällskapet för utgivande av Lantmäteriets Historia. 3 Vols. Vol. 1, VIII+629 p.; maps, ills.; Vol. 2, 614 p., maps, illus.; Vol. 3, 41 maps.Stockholm, Norstedt, 1928. ISIS

Reviewing this work, ERNST ANTEVS writes as follows (*Geogr. Rev.* 29, p. 352, 1929): « The above impressive volumes are issued to commemorate

the tercentenary of the Swedish Topographic Survey as a governmental institution and its thorough reorganization in 1908-1920. They treat the different phases and activities of the Topographic Survey during the past three hundred years in eighteen independent articles, among which may be mentioned : Organization of the Topographic Survey, Development of Surveyors, Technique of Surveying, and Cartography of the Topographic Survey. Several papers deal with legal and economic problems, land divisions, etc. The maps in volume 3 aim to give an idea of the different types of maps at different times. »

Taberner, Fernando Valls, and **Reparaz, Gonzalo de.** Historia de la geografía. *Geografía Universal*, I, 532-62, n.d., maps, illus.

ISIS

Brief, semi-popular sketch of the outlines of the history of geography illustrated with reproductions of early maps and with maps illustrating the progress of exploration. J. K. W.

Vera, Vicente. La prioridad de los navegantes españoles en las exploraciones del mar Pacifico. El descubrimiento de Australia. Documentos curiosos relativos a los viajes de PEDRO FERNÁNDEZ DE QUIROS y de LUIS DE TORRES. *Boletín de la Real Sociedad Geográfica*, 69, 94-102, 1929. ISIS

Wagner, Hermann *(editor). Geographisches Jahrbuch*, 44 Band, 1929. XIV+393 p., Gotha, PERTHES, 1930. ISIS

Includes the following bibliographical accounts of progress in the field of geographical research and exploration : J. BARTELS, Bericht über die Fortschritte unserer Kenntnisse vom Magnetismus der Erde (X, 1925-29), p. 3-36; K. KNOCH, Bericht über die Arbeiten aus dem Gebiete der geographischen Meteorologie 1926-28, p. 37-144; Bericht über die Fortschritte der geographischen Landeskunde europäischer Länder : B. V. DARBISHIRE, Die britischen Inseln, p. 145-166; FRIEDRICH LEYDEN, Belgien (1915-28), p. 166-94; Fr. LEYDEN, Luxemburg (1915-28), p. 195-96; K. OESTREICH, Die Niederlande (1915-28), p. 196-224; Bericht über die Fortschritte der Landeskunde der aussereuropäischen Erdteile : LEONID BREITFUSS, Die Erforschung des Nordpolargebiets in den Jahren 1913-28; Die innere Arktis und der europäische Sektor, p. 289-74.

32. — GEOLOGY, MINERALOGY, PALAEONTOLOGY, MINING.

(For palaeobotany, palaeozoology and palaeoanthropology, see respectively, 28. *botany,* 29. *zoology and* 39 *prehistory)*

Alberti, Annibale, and **Cessi, Roberto.** La politica mineraria della repubblica Veneta. Con lettera del ministro BELLUZZO al capo del governo, VIII+455 p. Rome, Libreria dello Stato, 1927. ISIS

Björkman, Edwin. The search for Atlantis : excursions by a layman

among old legends and new discoveries. 127 p. London, KNOPF, 1927. ISIS

Bouasse, H. Séismes et sismographes. 394 p. Paris, DELAGRAVE, 1927. ISIS

Geologica Hungarica. Fasciculi ad illustrandam notionem geologicam et palaeontologicam regni Hungariae. Series geologica, tomus 3 : Geographie und Geologie Nordalbaniens, von Baron FR. NOPCSA ; Mit einem Anhange von H. v. MZIK : Beiträge zur Kartographie Albaniens nach orientalischen Quellen. XIV+703 p. +35 p. Budapestini, Institutum Regni Hungariae Geologicum, 1929. ISIS

Reviewed by J. W. GREGORY, *Nature*, 125, 8-9, 1930.

Giehm, Gerhardt. Welterkenntnis und Weltenbau. Philosophisches zur Glazialkosmogonie. VIII+181 p. Leipzig, VOIGTLÄNDER, 1928. ISIS

Reviewed by R. ZAUNICK, in *Mitteilungen zur Gesch. d. Medizin*, 29, 77, 1930.

Jenkin, A. K. Hamilton. The Cornish miner. 351 p. London, ALLEN and UNWIN, 1927. ISIS

33. — METEOROLOGY, CLIMATOLOGY, AND TERRESTRIAL PHYSICS

Brooks, Charles Ernest Pelham and **Glasspoole, J.** British floods and droughts. With an introductory note by HUGH ROBERT MILL. 199 p. London, BENN, 1928. ISIS

Hess, Victor F. The electrical conductivity of the atmosphere and its causes. Translated from the German by L. W. CODD. XVIII+204 p. London, CONSTABLE, 1928. ISIS

Hobbs, William Herbert. Exploring about the North Pole of the winds. VIII+376 p., front., 26 ills., maps. London, PUTNAM'S Sons, 1930. ISIS

Shaw, Sir **Napier.** Agricultural meteorology : a brief historical review. Conference of Empire Meteorologists, 1929 ; Agricultural section, 2, Papers and Discussions, 3-13, London, 1929. ISIS

Brief critical sketch of development, particularly in England, of weather forecasting for agricultural purposes and of studies of the relation of weather to crops. J. K. W.

36. — PHYSIOLOGY *(human and comparative)*

Brim, Charles J. The story of blood pressure. *Medical life*, no. 113, 60-108, 42 ills., 1930. ISIS

Dejust, Verne, Combes, Parat, Urbain, Dujarric de la Rivière, de Saint-Rat. Études sur la chimie physiologique de la peau. 381 p. AMÉDÉE LEGRAND, Paris, 1928. ISIS

Reviewed by R. M. MAY, *Isis*, 13, 134-5, 1929.

Major, Ralph H. The history of taking the blood pressure. *Annals of Medical History*, 11, 47-55, 14 fig., 1930. ISIS

38. — ARCHAEOLOGY *(Generalities, methods)*

Gardner, G. A. Rock paintings of north west Cordoba. 44 pl., figs. Oxford University Press, 1930. ISIS

Montell, Gösta. Dress and ornaments in ancient Peru. Archaeological and historical studies. VIII+262 p., 5 pl., 98 fig., map. Oxford University Press, 1930. ISIS

Rickertson, Oliver, jr.; Kidder, A. V. An archeological reconnaissance by air in central America. With photographs by Mrs. LINDBERGH and OLIVER RICKETSON, jr. *Geographical Review*, 20, 177-206, 20 figs., 1930. ISIS

Woolley, C. Leonard. Dead towns and living men. Oxford University Press, 1930. ISIS

39. — PREHISTORY

Herig, F. Steinzeitliche Technik. *Beiträge zur Geschichte der Technik und Industrie*, 19, 92-98, 5 fig., Berlin, 1929. ISIS

Lenghel, Alexandru. Zwei trepanierte Schädel aus dem siebenbürgischen Landesmuseum in Cluj-Klausenburg. *Archiv für Geschichte der Medizin*, 23, 98-99, 2 figs., 1930. ISIS

40. — ETHNOLOGY *(Primitive and popular science)*

Fettweis, Ewald. Gerade Linie, Richtung, Parallelen, und Kreis auf niederen Kulturstufen. *Archeion*, 11, 366-74, 1929. ISIS

Comparaison des définitions grecques (EUCLIDE, PLATON, ARCHIMÈDE) de la ligne droite, des parallèles et du cercle, avec les notions qu'en ont les

primitifs d'aujourd'hui; il n'y a de différence sérieuse que pour le concept du cercle qui est généralement défini comme la ligne fermée comprenant la plus grande surface; l'idée du centre (définition grecque) est postérieure à celle de la surface, suggérée par la hutte d'habitation. L. G.

Fettweis, Ewald. Ueber die Enstehung der Messkunst. *Isis*, 13, 334-39, 1930. ISIS

« Das Studium der Messkunst bei Naturvölkern und primitiven Völkern führt zu einigen, wie mir scheint, für die Geschichte der Mathematik nicht wertlosen Ergebnissen. Zunächst wird, allerdings mit Einschränkungen, die Vermutung TYLORS bestätgt, dass die Messkunst sich, ebenso wie die Rechenkunst, am menschlichen Körper entwickelte. Weiter erkennt man, in wie ausserordentlich engem Anschluss an die Einzelheiten der Messgelegenheit oder des Messbedürfnisses ursprünglich die Messkunst entstand. Dann kann man ferner feststellen, dass ebenso wie auf die Entwicklung der Rechenkunst auch auf die Entwicklung der Messkunst ganz ausserhalb der Sache liegende Faktoren Einfluss gewinnen konnten, und schliesslich erkennt man den Einfluss, den auf primitiven Stufen die mangelhafte Entwicklung der Rechenkunst auf die Entwicklung der Messkunst gewinnen konnte. »

Lévy-Bruhl, Lucien. Die Seele der Primitiven. Autorisierte Übersetzung aus dem Französischen von ELSE Baronin WERKMANN. 367 p. Wien, BRAUMÜLLER, 1930. ISIS

Original text reviewed in *Isis*, 9, 482-86, 1927.

Malinowski, Bronislaw. The sexual life of savages in north-western Melanesia. An ethnographic account of courtship, marriage and family life among the natives of the Trobiand Islands, British New Guinea. With a preface by HAVELOCK ELLIS. 2 vols. XXVIII+ 603 p., 96 pl. New York, HORACE LIVERIGHT, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 395-97, 1930.

Marzell, Heinrich. Heilsegen aus dem bayerischen Franken. GEORG STICKER Festgabe, 27-38, Berlin, SPRINGER, 1930. ISIS

41. — SUPERSTITION AND OCCULTISM

Kittredge, George Lyman. Witchcraft in Old and New England. 641 p. Harvard University Press, Cambridge, Massachusetts, 1929. ISIS

Reviewed by LYNN THORNDIKE, *Isis*, 13, 138-41, 1929.

43. — SOCIOLOGY, JURISPRUDENCE AND POSITIVE POLITY

Degrange, McQuilkin. The curve of societal movement. A study

of the nature of sociology in the light of the positive politics of AUGUSTE COMTE. VIII+214 p. Hanover, N. H., Sociological Press, 1930.

ISIS

« This volume seeks to formulate a new definition of sociology, a definition that shall grow logically out of the work of the man who first clearly saw the need and the possibility of a science of social phenomena. It is therefore a return to the great line of thinkers that began with ARISTOTLE, came into Western Europe with the Arabs, and runs from the Scholastics through DESCARTES to COMTE. It seeks to apply to the task of founding a science of sociology the traditions of this long filiation. Back to COMTE, then. But back to COMTE, with a difference. Not back to the COMTE of the Positive Philosophy, and still less to the COMTE of HARRIET MARTINEAU's condensation of that work in the ever useful series founded by the Messrs. BOHN. No. It is a return to the product of the maturest thought of the great philosopher; it goes back to the COMTE of the Positive Politics. »

44. — HISTORY OF CIVILIZATION

(General history, historical methods, biography and chronology)

Buzeskul, V. P. General history and its exponents in Russia, in the XIXth and in the beginning of the XXth century. Part I. *Publications of the History of Knowledge Commission*, No. 7. I—218 p., 9 portr. Leningrad, Academy of Sciences, 1929. (In Russian).

ISIS

Previous issues of these *Publications* have been mentioned in *Isis*, 11, 234, 472, 489; 12, 387; 13, 476, 556; see also *Isis*, 11, 188, 199, 476; 12, 390; 13, 475, for the *Outlines of the History of Knowledge*. A work on the history of general history is not an intruder in these series. The official French translation of the titles of the two series, viz., *Travaux de la commission d'histoire des sciences*, and *Essais sur l'histoire des sciences*, gives a limited view of the field to be surveyed : « istoria znanii » means history of knowledge, Geschichte der Wissenschaften. Incidentally, the word « nauka » in the name of the Academy corresponds to μάθημα rather than to ἐπιστήμη. Part I of V. P. BUZESKUL's book contains a preface, an introduction, and the following five chapters : I. Beginning of scientific Byzantinology. II. Beginning of the study of the Slavic world. III. Beginning of the study of the history of Western Europe and of antiquity. IV. Study of general history in the 70's and 80's. V. V. I. GUERRIER (1837-1919), N. I. KAREEV (b. 1850), P. G. VINOGRADOV (1854-1925), I. B. LUCHIZKI (1845-1918), M. M. KOVALEVSKI (1851-1916). A. P.

Rádl, Emanuel. Natur und Geschichte. Festschrift Th. G. MASARYK zum 80. Geburtstage 7. März 1930. Erster Teil, p. 241-64. Ergänzungsband zur Zeitschrift *Der russische Gedanke*, Bonn, F. COHEN, 1930.

ISIS

« In der Schrift ' Der Kampf zwischen den Tschechen und Deutschen '

(1928) habe ich mich für eine Philosophie der Geschichte ausgesprochen, die an die soziologische Lehre TH. G. MASARYKS (*Isis*, 2, 238) anknüpft und dieselbe weiter zu entwickeln sucht. Dieselben Ideen habe ich bereits früher in einer (tschechisch geschriebenen) Broschüre ' Um den Sinn unserer Geschichte ' verteidigt. Die nachfolgende Auseinandersetzung stellt den Versuch einer theoretischen Begründung dieser Geschichtsphilosophie dar. »... « Wenn die Notwendigkeit der Naturgesetze nicht verbürgt wäre, dann ist das Naturgeschehen nicht mehr blind; es hat möglicherweise auch einen Sinn, es vollführt vielleicht einen Zweck. Dann aber würde es möglich sein, dass der Sinn der Menschheitsgeschichte mit demjenigen der Natur zusammenhängt; der menschliche Kampf für die Wahrheit hat dann vielleicht auf eine unbekannte Art einen Sinn für das ganze Weltall. Dann gibt es einen Weg von dem objektiv Gegebenen über die lebendige Natur zu den Idealen der Menschen und zu dem Sinne des Weltalls. Und die Worte des Psalmisten von den Himmeln, die die Ehre Gottes erzählen, würden von neuem eine Berechtigung erlangen. »

Redlich, Oswald. Festschrift zu Ehren OSWALD REDLICHS. (*Veröffentlichungen des Museum Ferdinandeum in Innsbruck*, Heft 8, Jahrg. 1928). 632 p., map, illus., table. Innsbruck, Universitäts-Verlag WAGNER, 1928. ISIS

A series of papers dealing in the main with Tyrolese history. Note especially: I. P. DENGEL, Reisen Mediceischer Fürsten durch Tirol in den Jahren 1628 und 1667/8, p. 1-45.

Robinson, James Harvey. Civilization. 62 p. London and New York, Encyclopaedia Britannica, April, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 136-7, 1929.

Robinson, James Harvey. The newer ways of historians. *American Historical Review*, 35, 245-55, 1930. ISIS

Presidential address delivered before the Amer. Hist. Association at Durham, December 30, 1929.

46. — HISTORY OF LANGUAGE, WRITING AND LITERATURE

Baeteman, J. (Missionnaire lazariste). Dictionnaire Amarigna-Français. Suivi d'un vocabulaire français-amarigna. XXI+433 p. Dire-Daoua (Ethiopie) Imprimerie Saint Lazare des RR. PP. Capucins, 1929. (En vente chez PAUL GEUTHNER, Paris, 100 francs.) ISIS

The first book printed in Amharic was a translation of the Psalms, published by MARCELLUS SILBER in Rome, 1513 (I saw a copy of it in the Annmary Brown Memorial in Providence, R. I.). The earliest Amharic texts printed on Aethiopian soil appeared only a few years ago (*Isis*, 7, 314, also figs. 10, 11, opposite p. 171). The present dictionary is probably the most important publication ever printed in Aethiopia. It is not the first dictionary. HIOB

LUDOLF published a Lexicon aethiopico-latinum in London, 1661 (2nd ed., Francfort, 1699) and a Lexicon Amharico-Latinum in Francfort, 1698 (Thus not at the end of the eighteenth century as the author says, but a full century earlier?). As far as I know no dictionary was published during the eighteenth century but quite a few appeared in the nineteenth and twentieth centuries. The author's preface contains an account of Amharic Lexicography, which is very interesting, but needs revision and deserves amplification. C. H. WALKER's English-Amharic Dictionary (London, Sheldon Press, undated, 1928) appeared probably too late to be known to him.

BAETEMAN's Dictionary claims to be more elaborate than its predecessors. The author was able to avail himself not simply of these, but also of various MS. works, of the abundant vocabulary and of the many gleanings of all kinds collected during a very long stay in the country. For example, the significance of words is often illustrated by means of proverbs. This is an excellent method as there are no literary works of sufficient authority to be used as sources of examples. The book is beautifully printed and remarkably cheap.

The author published previously an Amharic grammar which we have not seen, but which is presumably identical with the one mentioned in *Isis*, 7, 314. G. S.

48. — HISTORY OF PHILOSOPHY

(See also above 18. *philosophy of science)*

Cresson, André. Les systèmes philosophiques. 220 p. Paris, COLIN, 1929. ISIS

Exposé rapide, fait suivant une méthode de classement rigoureuse, non pas des différents systèmes philosophiques, mais des types de doctrines conçus par les philosophes, ces types de doctrines étant étudiés en fonction les uns des autres, donc aussi bien avec les arguments de leurs adversaires qu'avec ceux de leurs partisans. L'auteur ramène ces théories à trois types : les dogmatismes (p. 25-166), groupant trois écoles qui s'opposent : les naturalismes, les spiritualismes, les idéalismes; les agnosticismes (167-190), c.à.d. le scepticisme et le relativisme; enfin les philosophies de la croyance : le probabilisme et le pragmatisme. On retrouve dans ce petit livre la clarté, la vie qu'HÉLÈNE METZGER signalait en rendant compte du précédent ouvrage du même auteur : Les courants de la pensée philosophique française (*Isis*, 9, 489-90). L. G.

Meyerson, Emile. Identität und Wirklichkeit, Deutsch von KURT GRELLING nach der dritten Auflage des Originals. Eingeleitet und mit Anmerkungen versehen von LEON LICHTENSTEIN. XL+534 p. Leipzig, Akademische Verlagsgesellschaft, 1930. ISIS

See review of the third edition of the original text by H. METZGER, *Isis*, 9, 470-72.

VII. MEDICINE

50. — HISTORY, ORGANIZATION, AND PHILOSOPHY OF MEDICINE

Beneke, Rudolf. Vom Einfluss Hallischer Kliniker auf die Entwicklung der deutschen Balneologie. *Leopoldina*, 5, 110-23, 1929. ISIS

Cushing, Harvey. The binding influence of a library on a subdividing profession. WELCH Festschrift. *Bull. of the Johns Hopkins Hospital*, 46, 29-42, 1930. ISIS

Dawson, Warren R. The mouse in Egyptian and later medicine. *Journal of Egyptian Archaeology*, 10, 83-86, 1924. ISIS

Garrison, Fielding H. An introduction to the history of medicine. With medical chronology, suggestions for study and bibliographic data. Fourth edition, revised and enlarged. 996 p., 286 portraits and other illustrations. Philadelphia, SAUNDERS, 1929. ISIS

Reviewed by GEORGE SARTON, *Isis*, 13, 137-38, 1929.

Hancock, J. Duffy. The Irish school of medicine. *Annals of medical history*, 11, 196-207, 7 figs., 1930. ISIS

Hansen, Axel. JOHN WILLIAM SCHIBBYE JOHNSSON. *Isis*, 13, 320-4, pl., 1930. ISIS

J. W. S. JOHNSSON (1868-1929). Danish historian of medicine. Biography, portrait and bibliography.

Hirsch, August *(editor)*. Biographisches Lexikon der hervorragenden Ärzte aller Zeiten und Völker. Zweite Auflage durchgesehen und ergänzt von F. HÜBOTTER und H. VIERORDT. Zweiter Band. CHAVET-GYULAY, mit 64 Bildnissen. 926 S. Berlin, URBAN & SCHWARZENBERG, 1930. (geb. RM. 66). ISIS

The first volume of this standard work was reviewed in *Isis*, 14, 565. The second volume is composed in the same way; that is, the supplements which appeared in vol. 6 of the first edition (1888) have been incorporated in the text of the original vol. 2 (1885). The number of pages of that vol. 2 and its supplements amounted to 933, which shows that there has been no room for any addition. There is no doubt that the new edition will be much easier to use than the first; it is printed on beautiful white paper and adorned with 66 portraits on 16 plates. Every reference library which lacks the first edition should obtain a copy of the second. G. S.

Long, Esmond R. Selected readings in pathology: from HIPPO-

CRATES to VIRCHOW. XIV+305 p., 26 pl. London, BAILLIÈRE, 1929. ISIS

Reviewed by B. C., *Nature*, 125, p. 488, 1930.

Menetrier, P. ; Neveu, R. Le professeur RAOUL BRUNON (1844-1929). *Bulletin de la Société française d'histoire de la médecine*, 24, 44-6, 1930. ISIS

Neuburger, Max. Philosophische Bestrebungen und Kundgebungen im alten medizinischen Wien. *Archiv für Geschichte der Medizin*, 23, 101-12, 1930. ISIS

Robinson, Victor. Pathfinders in medicine. 2nd edition. XVII+ 810 p., 150 pl. New York, Medical Life Press, 1929. ISIS

The first edition of this handsome volume appeared in 1912; it was considerably smaller (317 p., 15 pl.) and contained only 15 chapters instead of 30. The second edition is more than doubled. The original chapters remain, but fifteen new ones have been added, also abundant illustrations. The physicians dealt with are: GALEN, ARETAEUS, RHAZES, PARACELSUS, SERVETUS, VESALIUS, PARÉ, DESCARTES, MALPIGHI, HUNTER, JENNER, CAVENDISH, SCHEELE, BERZELIUS, GUTHRIE, LAENNEC, PURKINJE, SCHLEIDEN, SCHWANN, HENLE, DARWIN, SIMPSON, DUCHENNE, BERNARD, HEBRA, SEMMELWEIS, BLACKWELL, PASTEUR, KOCH, METCHNIKOFF, PAVLOFF. The book is enriched with a large number of portraits, autographs, facsimiles, etc. ROBINSON's medical sketches will be very instructive for the younger students; their digressiveness and recklessness would irritate scholars, but then they are not meant for them. Some statements are inexcusable as for example, on p. 393 « the thousand years of insanity known as the Middle Ages ». It is clear that the author shares SCHLEIDEN's habit (p. 409) « of reaching conclusions on insufficient evidence ». In fact he jumps to them all the time. Because of its very digressiveness, the book contains much unusual information and because of its outspokenness it is as stimulating as one would wish. The author's lack of criticism is redeemed by a great generosity and enthusiasm.

G. S.

Sigerist, Henry E. Bericht über die Tätigkeit des Instituts im Jahre 1927-28. *Kyklos*, 2, 287-92, 1929. ISIS

Annual report of the Institut für Geschichte der Medizin an der Universität Leipzig.

Sigerist, Henry E. Die Sonderstellung des Kranken. *Kyklos*, 2, 11-20, 1929. ISIS

Sigerist, Henry E. Forschungsinstitute für Geschichte der Medizin und der Naturwissenschaften. 15 p. Sonderdruck aus dem Werk : Forschungsinstitute, ihre Geschichte, Organisation und Ziele,

herausgegeben von LUDOLPH BRAUER, MENDELSSOHN BARTHOLDY und ADOLF MEYER, im PAUL HARTUNG Verlag, Hamburg (no date, received March 1930). ISIS

Sticker, Georg. Historische Studien und Skizzen zu Natur- und Heilwissenschaft. Festgabe GEORG STICKER, ordentlichem Professor der Medizingeschichte zu Würzburg, zum siebzigsten Geburtstage dargeboten. VII+152 p., port. Berlin, SPRINGER, 1930 (RM. 15). ISIS

A beautiful Festschrift with a portrait of the great historian of epidemics, and a preface by KARL SUDHOFF. The best way to bring to a larger circle of scholars some knowledge of the whole book and of its contents is not to review it but to analyze its contents in our bibliography (and this is done in the present one). Each item put in its proper place will call the reader's attention to itself and indirectly to the whole book and to the great scientist for whose sake it was written. The Festschrift includes seventeen papers and lists of STICKER's publications and of his academic lectures. He gave his first course on the history and philosophy of medicine in Giessen, 1895! Our best wishes to him, may he be granted many more years of health, work, and happiness. G. S.

Sudhoff, Karl. Address delivered at the inauguration of the department of the History of Medicine at the Johns Hopkins University, Baltimore, October 18, 1929. Translated by FIELDING H. GARRISON. WELCH Festschrift. *Bull. of the Johns Hopkins Hospital*, 46, 101-46, port., 1930. ISIS

Sudhoff, Karl. Toledo! *Archiv für Geschichte der Medizin*, 23, 1-6, 1930. ISIS

(Welch, William H.) Inauguration of the department of the History of medicine of the Johns Hopkins University, and the opening of the WILLIAM H. WELCH Medical library. *Annals of Medical History*, 11, 122-27, 1930. ISIS

51. — EPIDEMIOLOGY, HISTORY OF SPECIAL DISEASES. PUBLIC HEALTH AND SOCIAL MEDICINE.

Jeanselme, E. Questionnaire relatif à l'histoire de la lèpre. *Bulletin de la Société française d'histoire de la médecine*, 23, 344, 1929. ISIS

Kanner, Leo. The folklore and cultural history of epilepsy. *Medical life*, 37, 167-214, 1930. ISIS

Contents: 1. The folk-etiology of epilepsy; 2. The folk-treatment of epilepsy; 3. Bibliography.

Messeloff, Charles R. Historical aspects of rheumatism. *Medical Life*, 37, 3-56, 11 ports., 1930. ISIS

Regnault, Félix. Rôle de la clinique et du laboratoire dans les découvertes de pathologie : fièvre puerpérale et typhus exanthématique. *Bulletin de la Société française d'histoire de la médecine*, 23, 359-63, 1929. ISIS

52. — HISTORY OF HOSPITALS AND OF MEDICAL TEACHING

Lossen, Heinz. Aus der Geschichte des Hospitals zum Heiligen Geist in Frankfurt a. M. GEORG STICKER Festgabe, 55-62, Berlin, SPRINGER, 1930. ISIS

53. — PHARMACY. PHARMACOLOGY. TOXICOLOGY.

Kremers, E. History of pharmacy. *Isis*, 13, 359-61, 1930. ISIS

Orient, Julius. Aus pharmazeutischer Vergangenheit Siebenbuergens und des Banates. Ins Deutsche Uebersetzt von Edgar Mueller. 58 p., 18 ills. Gesellschaft für Geschichte der Pharmazie. ISIS

This, the latest publication of the Gesellschaft für Geschichte der Pharmazie, will receive the usual welcome from all lovers of the pharmaceutical past. Beginning with the Daci and Romans, it traces the beginnings of pharmacy through the periods of the Huns and the conquest by the Magyars. The influence of monkish pharmacy, the devastating influences of Turkish supremacy and of the plague, of the effects of the reformation and of the counterreformation by the Jesuits, who knew well the influence they could exercise over the common people through their apothecary shops, all receive attention. Of interest also are references to the patronizing of pharmacy by the wordly rulers both under the Hungarian and Austrian regimes. Lastly, a chapter is devoted to the Pharmaceutical Museum in Klausenburg. Each chapter is provided with an initial designed with reference to that phase of the pharmaceutical past discussed therein. E. K.

VIII. EDUCATION (the methods of accumulating, imparting and diffusing knowledge)

54. — EDUCATION *(Generalities, methods, colleges, universities)*

Disselhorst, Rudolf. Die medizinische Fakultät der Universität Wittenberg und ihre Vertreter von 1503-1816. *Leopoldina*, 5, 79-101, 1929. ISIS

Morison, Samuel Eliot. The development of Harvard University

since the inauguration of President ELIOT, 1869-1929. XC+660 p. Cambridge, Mass., Harvard University Press, 1930. ISIS

Walther, Johannes. Aus der Geschichte der Universität Wittenberg. Vortrag, gehalten am 18. Juli 1929 im Schloss zu Wittenberg. *Leopoldina*, 5, 1-8, 1929. ISIS

With a portrait of the first rector, MARTIN POLLICH-MELLERSTAD (1502-13) and a reproduction of the horoscope of foundation of the university.
G. S.

55. — ACADEMIES, SOCIETIES, CONGRESSES. NATIONAL AND INTERNATIONAL ORGANIZATION OF SCIENCE.

(Societies and congresses devoted to particular sciences are classified under those sciences. For the internal organization of science — Isis, I, 195 — *see section* 17*)*

Index Generalis 1929-1930. 2322 p., édit. SPES, Paris, 1930. ISIS

Cet annuaire, fondé et dirigé par R. DE MONTESSUS DE BALLORE, paraît tous les ans depuis 1919. La première partie, environ 900 pages, concerne les Universités et écoles supérieures du monde entier, Russie exceptée malheureusement.La deuxième partie se rapporte aux observatoires, bibliothèques, dépôts d'archives, instituts scientifiques, sociétés savantes. Elle est suivie d'une table alphabétique des quelque 60000 personnalités scientifiques citées dans les deux premières parties, et de tables géographiques. J'ai souvent recours à cet annuaire, il ne me déçoit pas, sauf encore une fois pour la Russie.
L. G.

Schuster, Julius. Die wissenschaftliche Akademie als Geschichte und Problem. 13 p. Sonderdruck aus dem Werk : Forschungsinstitute, ihre Geschichte, Organisation und Ziele, herausgegeben von LUDOLPH BRAUER, MENDELSSOHN BARTHOLDY und ADOLF MEYER, im PAUL HARTUNG Verlag, Hamburg (no date ; received March 1930). ISIS

56. — BIBLIOGRAPHY *(Methods, libraries)*

Hamor, William A.; Bass, Lawrence W. Bibliochresis : the pilot of research. *Science*, 71, 375-78, 1930. ISIS

Bibliochresis—the scientific use of literature.

MacNair, Mary Wilson. A list of American doctoral dissertations printed in 1928. VII+250 p. Washington, D. C., Library of Congress, 1930. ISIS

59. — ERRATA. SERIES 21.

(For previous ones, see Isis, 14, 568*)*

Vol. 11, p. 165, first note. Read TUFFRAU, instead of Tuffau.
Vol. 12, index, p. 546. HUYGENS, CH. Read XI, 111, instead of X, 111.
Vol. 13, p. 437. The note HUIZINGA ought to be classified under XVIth century, first half, E.

A few other misprints are not mentioned in these errata because they are too obvious to cause any error or confusion. I wish to express my thankfulness to the readers who take the trouble to make the above-mentioned corrections in their copies of *Isis* and the Introduction. I would advise them, after having accomplished that little task, to write their initials near mine at the bottom of this note, thus to indicate that these and the previous errata have been taken into account. G. S.

These and previous errata have been corrected by...
The corrections have been made in the card index by...

Author's Index to the Twenty-Ninth Bibliography.

The Roman figures refer to centuries ; the Arabic figures, to the sections of Parts II and III, which are numbered consecutively from 1 to 59. This index will enable one to find more easily the papers analyzed in the present bibliography, and also to see at a glance what each writer is doing.

June 20, 1930. FRANCES SIEGEL.

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